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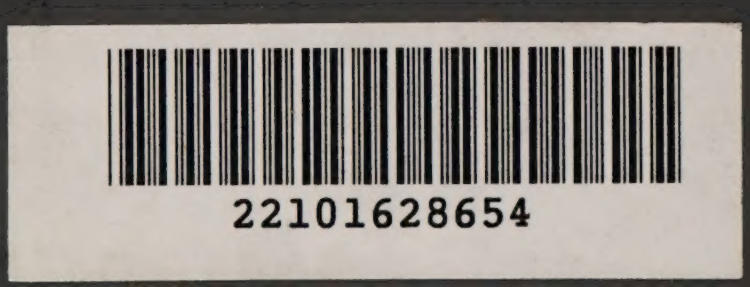
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Edgar J. Cyriax

A MANUAL

OF

TREATMENT BY MASSAGE

AND

METHODICAL MUSCLE EXERCISE.

BY

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TRANSLATED, WITH THE AUTHOR'S PERMISSION,

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PREFACE TO THE TRANSLATION.

THE growing tendency of modern Therapeutics to do away as far as possible with the use of Drugs, and to seek to cure disease by the application of the laws of Hygiene, has made it seem desirable to present to the medical public a practical work on that oldest branch of the healing art, namely, Mechano-Therapy.

With this end in view, the following translation of a work by an eminent practitioner of the art has been prepared by permission of the Author. It is the hope of the Translator and Publishers that its dissemination may serve the purpose of more extensively introducing the use of this simple yet efficacious means of treating many painful diseases, and so may contribute to the relief of suffering humanity.

W. M.

NEW YORK, 1887.

PREFACE TO THE GERMAN EDITION.

My object in writing this work has been to afford the practising physician a trusty guide to the mechanical treatment of disease.

During its preparation—which was greatly prolonged owing to the time required to furnish the necessary illustrations—no less than four large works on the same subject appeared in the German language, namely, those of Rossbach, Busch, Reibmeyer, and Samuely.

I confess that the successive appearance of these caused in me no little alarm, for I could not suppress in myself the feeling that each of them might make my own work unnecessary, not to mention laying it under the suspicion of being a mere plagiarism.

However, these fears have proved to be without foundation, for I think I have succeeded in presenting my subject from a new point of view, and thus filling a gap in the literature of mechano-therapy.

Throughout it has been my endeavor to elucidate the mechanical method by citations of cases which have come within my personal observation, and to call attention to both peculiar and unforeseen difficulties, as well as to introduce, wherever possible, such practical hints as will facilitate the execution of the various manipulations.

Should this work fulfil these expressed intentions, I feel that it may be a not unwelcome offering to many of my colleagues.

THE AUTHOR.

Aussee, Styria, Austria.

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MASSAGE AND METHODICAL MUSCLE EXERCISE.

INTRODUCTION.

HISTORY OF MECHANO-THERAPY.

The method of healing disease by mechanical means dates back to the oldest literary records of the Hindoos and Chinese; the celebrated book of the Hindoos, the *Susruta*, written long before the Christian era, containing excellent descriptions of medical gymnastics. The system was originally free from all superstitious observances, but it soon became invested by the Brahmins with various mysteries, of a kind calculated to deceive the popular mind into a belief in its divine origin. The priests thus not only increased their revenues, but, at the same time, fostered the credulity of the common people in the power of the remedy. The Brahmins continue, to the present day, to use the same methods they did three thousand years ago.

The oldest book of the Chinese, the *Cong-Fou*, contains detailed accounts of medical gymnastics, illustrated by drawings which show what correct ideas on mechano-therapy this ancient nation had.

In a book by F. Lutterbach, bearing the pompous title, *Revolution in the Art of Walking*, which appeared in Paris in 1850, we find most divers modes of respiration treated of; yet they were known to Chinese physicians centuries ago. The title of the book *Cong-Fou* indicates its contents: "Cong" meaning an art, "Fou" a man; therefore, "the man who uses an art" [or perhaps "the art used upon man"?].

According to recent researches, there can be no doubt that it contains directions for treating, by gymnastics, sprains, dislocations, and other similar surgical ailments.

According to P. Duhalde, there are in all provinces of the Celestial Empire medico-gymnastic schools for the education of physicians (who are called *Tao-See*), at which hundreds of patients congregate from all quarters of China to be treated. One of the most celebrated of these establishments is in the province of Kiang-Si, and the city of Kan-Tschean-Fou ranks as the chief centre for the Tao-See, being the residence of their grand master, who bears the title of *Tien-See—i. e.*, "celestial physician."

In his work on *The Chinese as They Are* (London, 1841), Dr. T. Lay tells of an ingenious and effective means by which Chinese physicians treat spinal curvatures. It consists in the performance of certain definite muscle exercises, simultaneously with deep and prolonged inspirations; in this way the respiratory muscles are brought in to support those lying along the spinal column. Since time immemorial the Chinese seem to have used gymnastic exercises to strengthen muscles relaxed from over-fatigue, as also to remove cramps and rheumatic pains. Instead of bleeding, as was formerly the case with us, medical gymnastics were used by them for the removal of a plethoric habit. Whether or no they based their mechanical treatment on physiological grounds, or deduced it from some therapeutic doctrine, we have no idea.

In an encyclopædia, consisting of sixty-four volumes, which appeared in the sixteenth century, under the title of *San-Tsai-Tou-Hoei*, there is a collection of woodcuts representing anatomical figures and gymnastic exercises.

With the Hindoos this ancient mechanical treatment goes by the name of "shampooing," and in the Dutch Pacific colonies it is called "pidjet-ten," and is in use as a domestic remedy for the relief of pain in all the islands of the Indian Archipelago.

It is from the Hindoos and Chinese that a knowledge of mechano-therapy seems to have been transmitted to the Greeks and Romans, and the celebrated axiom of *mens sana in corpore sano*, comes to us from Democritus, a noted physician of Abdera.

Herodicos must be looked upon as the father of medico-gymnastics with the Greeks. He lived a short time before the Peloponnesian war, and was the first to lay down principles for

rational mechanical methods of treatment. He was also the teacher of Hippocrates (born 460 B. C., on the island of Cos), who first gave utterance to that saying, which is daily gaining in appreciation: *Natura sanat morbos; natura magister, medicus minister naturæ.*

His directions for treatment are confined to a proper selection of diet, and to the observance of a suitable proportion between exercise and rest. Hippocrates extended on a scientific basis the principles laid down by his master, and his doctrines on bodily exercise were accepted by the most celebrated physicians of Greece and Rome, such as Antillos, Orisabius Asclepiades, Athenæus, Celsus, and Galen; the latter teaching nine different kinds of massage.

Plutarch tells how Cæsar was cured of a general neuralgia, by being manipulated daily by a slave. It was only in the period of her decadence that Rome substituted the brutal athletics of her barbarous circus sports, for the refined bodily exercises introduced from Greece. The Christianity of the Middle Ages resolutely turned its back on all Roman customs; gymnastics, as practised in Rome, were banished, and mechano-therapy thus sunk into the hands of quacks and "bone-setters." In the year 1680, about the same time, therefore, that Bacon, Descartes, and Newton gave those learned theories to the world which have opened so many new pathways to the science of medicine, Borelli published his work, *De Motu Animalium*, which formed the foundation for the iatro-mechanical school, opposed to the iatro-chemical, established by Paracelsus.

The iatro-mechanists sought to explain all movements and functions of the body by mathematical and mechanical formulas; nevertheless, instead of seeking to cure disease by the physical methods they established, they still had recourse to the chemical agents of their opponents.

In 1740 there appeared an English work by Francis Fuller, called *Medical Gymnastique, or Every Man his own Physician*, a treatise on the influence of motion on the animal economy and its importance in the cure of different diseases, as consumption, dropsy, melancholy, etc. This book attracted much attention, and went through several editions. It was translated into a

number of different languages, and gave rise to numerous special works, such as the *Dissertatio de arte gymnastica nova* of von Börner, and the *De gymnaticæ medicæ veteris inventoribus* of von Gehricke, both of which appeared in Helmstadt in 1748. But at that time the medical world was too much occupied with pharmaceutical and chemical speculations to give much attention to the kinetic methods of the ancient Greeks and of the Tao-See.

In 1781, forty-one years after the appearance of Fuller's book, a French physician, Clement Joseph Tissot, published a work bearing the title *Gymnastique médicale ou l'exercice appliqué aux organes de l'homme d'aprés le lois de la physiologie de l'hygiéne et de la thérapeutique.* While both the English and the French work show but little knowledge of true medical gymnastics, they give proof of the high importance attached to the effects of regular and methodic exercise on the living organism. Far more thorough treatises on this subject were produced by Barthez and the brothers Weber. In 1794 John Pugh's *Treatise on the Science of Muscular Action* appeared, and in 1808, in Edinburgh, Dr. John Barclay's work, which deserves especial commendation, entitled *The Muscular Motions of the Human Body.* He records a case of severe rheumatic muscle contracture, which, after resisting all treatment, was finally cured by simply percussing the affected sterno-cleido-mastoid. Nevertheless, although cases cured by medical gymnastics gradually became known, but little attention was paid to the subject. The works on the different branches of kinesipathy multiplied notwithstanding. Among these may be mentioned *Illustrations of the Power of Compression and Percussion in the Cure of Rheumatism, Gout, and Debility of the Extremities, and in Promoting Health and Longevity*, by Balfour, Edinburgh, 1819; and *Méthode nouvelle pour le traitement des déviations de la colonne vertébrale*, by Pravaz, Paris, 1827.

A marked progress in mechano-therapy was attained by M. Blache when his paper, *Du traitement de la chorée par la gymnastique*, was read before the Académie de Médecine, in 1855. In this he showed that mechanical methods not only equalled in efficiency those generally used, but were also free from many of the disadvantages of the latter (see the chapter on "Chorea").

The most powerful impetus, however, given to the revival of mechano-therapy originated with a Swede, the creator of the modern "movement-cure," whose doctrines, spreading to England and to Germany, have after many decades, and in spite of being marked by some extravagancies, gained universal recognition.

The biography of this man only confirms the old experience that, as a rule, all new ideas force their way but slowly; and that their originators have often to struggle against old and firmly rooted views; that they are often, without fair trial, held up to ridicule as the product of a too fervid imagination, to be laughed at, criticised, and condemned.

Peter Henry Ling was born in 1776, in Ljunga Smaland, Sweden, and attended, in 1804, the University of Copenhagen, where he frequented the fencing academy established there at the beginning of this century by two French "émigrés." Having been cured of a rheumatic trouble in his arm by fencing, the thought struck him that systematic bodily exercise might exert a favorable influence generally on the human body and mind. Little by little he evolved the idea that the harmonious development of the various parts of the body should form an integral element in a national education, and with persistent endurance he labored to make this idea a reality. At that time there was at the military academy of Copenhagen a gymnasium under the direction of an excellent teacher of the name of Nachtigall, who was endeavoring to reduce gymnastics to their true principles. In these efforts he found a ready supporter in Ling, who eagerly studied those remnants of knowledge of gymnastics found in the medical works of the ancient Greeks. Finally, in 1806, Ling was appointed fencing master to the University of Lund, and he at once went to work to give a practical outlet to his aspirations. He soon found, however, that he lacked the information most necessary to attain perfect results, namely, a knowledge of anatomy, physiology, and other natural sciences, and he, therefore, applied himself to master these studies.

In order to give some idea of his general attainments, it may be mentioned that he was elected a member of the

Swedish Academy in recognition of some historical and poetical productions.

For many years, however, Ling was forced to struggle against ignorance and prejudice. When, in 1812, he applied to the Minister of Education of Sweden for government support to push his endeavors, he was met with the reply: "There are already plenty of acrobats and rope-dancers without maintaining more at State expense." This answer, though disheartening, did not discourage Ling, and he was finally so successful in his endeavors that in 1813 the "Central Institute of Gymnastics" was established in Stockholm by royal decree. Here Ling was enabled to perfect and propagate his methods, and in a short time they were introduced, not only into all public schools, but into orphan and insane asylums, several hospitals, and into the army. At the same time his lectures, held at the Institute, were thronged as well by men of every age and occupation, who came to learn, as by the sick, who came to be cured at his hands.

At first, the medical profession gave the new idea but little encouragement, but they were forced to recognize its merits on actually beholding the cure of numerous ailments which had before resisted all forms of treatment. Finally, many physicians became zealous disciples and propagators of the new doctrine.

Meanwhile, Ling steadily rose in honor and esteem. The King gave him the title of Professor, and created him a Knight of the Order of the North Star. But he was not destined long to enjoy the fruits of his indomitable energy, for consumption, whose progress he had by his own methods stayed for a while, put an end to his career in 1839, in the sixty-second year of his age. The prime idea of his life was not forgotten even in his last hours, and on his deathbed he recommended the gymnasium he had founded to the patronage of the King and the support of the State.

During his busy life he had occupied himself exclusively in putting his observations upon a broad experimental basis, and in trying to deduce their fundamental laws; but he did not find time to formulate his doctrines. His larger work, *A Treatise on the General Principles of Gymnastics*, at which he

worked from 1834 till the time of his death, was, by his own orders, completed by two of his pupils, Dr. Liedbeck and Georgii, who had directed the Institute during his illness. Massmann has translated the work into German.

After Ling's death the direction of the Institute was undertaken by Branting. The building in which it is situated contains spacious halls for gymnastic exercises and rooms for lectures, in which the following branches are taught: descriptive anatomy, including dissecting; physiological anatomy so far as it relates to the movements of the body; the principles and theory of gymnastics; gymnastics with and without apparatus; medical gymnastics; and, in addition, fencing exercises of all kinds. The educational staff consists of a director, a sub-director, three professors, and eight tutors (docents). Three hundred fencing masters are graduated annually, besides several hundred chronic sick being treated for their diseases.

THE LING METHOD.

Among the Greeks the harmonious development of all the organs of the human body formed the foundation of education, not only of the youth alone but of the nation at large. This sentiment pervaded their works on philosophy, and is found practically embodied in all their laws; and was besides put into actual practice in all institutions of learning, and at the public games. It was placed under the protection of Apollo, who, according to Plutarch, bestows health and intellect on mankind by favoring the development of the body and the harmonious production of strength.

Ling recognized the fact that the nourishment and development of the muscles depended on the amount of active movement they performed.

N. Dally affirms that Ling was probably acquainted with the report of Père Amiot, or some other Chinese treatise, which had reached him through missionaries, or through persons connected with the European embassies in China, and that his teachings, in theory as well as practice, are nothing more than exact reproductions from the *Cong-Fou* and the *Tao-See*. Ling's

biographer and pupil, Georgii, says: "The genius and powers of observation of Ling constantly afforded him new means whenever he felt their need. The ingenuity with which he devised new forms of movement to meet each indication may be looked upon as a kind of compensation for the imperfect physiological and biological knowledge which existed at that time. He left to his pupils such manifold and numerous directions for movements that it has required years to study, to explain, and finally to incorporate them into the science of physiology and therapeutics." And yet, according to Dally, all his directions are contained in the *Cong-Fou!*

It might be well to remark that the idea of curing by movement had been broached by Mercuriali as early as the middle of the sixteenth, and by Hoffmann in the middle of the eighteenth century, but without leading to further adoption. Their methods sank into oblivion, just as the movement cures of the Greeks and Romans had done before them. Jerome Mercuriali, of Verona, according to Daremberg,[1] spent seven years of his life in collecting from the manuscripts of the Vatican everything pertaining to gymnastics, and in 1569 he published at Venice the first edition of his work *De Arte Gymnastica.* Unfortunately, Mercuriali does not seem to have caught the spirit of the ancients. He evidently did not quite understand what was meant by "gymnastic exercise." It is true he recounts their method of dividing movements into active, passive, and combined, but he drew no conclusions from his knowledge. The errors he made were repeated by others, without investigating and testing anew, and thus it was the new science made no progress.

From the study of the ancients there arose in medicine three new systems: that of Stahl, called the iatro-mechanical; that of Boerhaave, the iatro-dynamical; and that of Friedrich Hoffmann, the mechano-dynamical. In all these three systems some form of motion played the principal part in the bodily functions, and from this idea the modern biological view of medicine has been developed. All the more modern systems of medicine recognize, so far as physiology, pathology, and

[1] Daremberg: Essai sur la détermination et les caractères des périodes de l'histoire de la médecine. Paris, 1850.

therapeutics go, the effects of motion on psychical education, preservation of health, and the cure of disease.

It is in the mechano-dynamic doctrine of Friedrich Hoffmann that the first attempts at therapeutic gymnastics of the German school are to be found, and as Hoffmann's is a name in the history of medicine too interesting to be passed over without a word, the following brief sketch of him is given.

He was born in 1660, in Halle, in Saxony; was made professor in the university there in 1694; and for forty-eight years lectured on medicine. He was equally renowned both as a practitioner and as an author. Perhaps the highest praise he ever won was from Boerhaave, who, when consulted professionally by the then reigning king of Prussia, Frederick William I., said, "Your Majesty, my best advice is this: consult Hoffmann."

The underlying principle found in all of Hoffmann's writings (collected in his great work, *Medicina rationalis systematica*) he formulates thus: "The human body, like all other bodies in nature, possesses material forces, by means of which it effects its movements. All these forces may be reduced to mechanical and mathematical principles. An imponderable, but material agent, *æther* (the active moving force), animates all tissues of the body, and presides over physical phenomena in every domain of creation."

He says, furthermore: "The living organism exercises the functions peculiar to itself in consequence of qualities inherent to all animal matter, which qualities are animated by a motive force emanating in the form of a certain peculiar material which is secreted by the brain, and carried into the body, and is under the regulation of a complicated organic apparatus. This æther is the fundamental cause of all vital motion. It animates every organ, the functions of the latter ceasing the moment the vivifying æther is no longer conducted to them. Sight and hearing are abolished when the nervous fluid is withdrawn."

According to Hoffmann, the nervous æthereal fluid is nothing else than the sentient soul presiding over organic life and conditioning the very existence of man.

Again, he says: "Medicine will never progress until we

closely examine the nature of this form of motion originating in the sentient soul, and until we apply to medicine the laws of mechanics and hydraulics."

In Hoffmann's therapeutics the chief parts are played by bodily exercise and rest, diet, and cold water, and by the observance of the simple laws of health. The system, it is true, contains errors and imperfections such as were peculiar to his time, but his principles stand as firm to-day as ever, and will always remain as pillars of strength to the science of medicine. It was he who first said to the scientific world: the human body is but a machine, and subject to mechanical laws. He then knew what was taught a hundred years later by the Swedish school, that pressure on the phrenic nerve in the neck would relieve a cramp of the diaphragm. He was the founder of our modern school of medicine, whose constant aim is to return to simplicity.

In his writings, *Dissertationes physico-medicæ*, 1708, the sixth division of the first volume bears the superscription, "Motion the best means of cure for the body;" and in the first chapter, "On the attainment of long life," he quotes the saying of Celsus, "The best of all medicines is—none."

When we consider that Hoffmann wrote his celebrated work at the beginning of the last century we cannot enough admire the illumined mind which shows itself throughout his writings. The preface to the work cited might have been written by Skoda himself, and such clearness, moderation, and love of truth are displayed in it that it merits a reproduction here.

He says: "He who carefully observes and tests Nature's art of healing, is forced to the conclusion that the basis of all health, life, and disease is an exceedingly simple one, which never changes, and is never confused. It is a matter of surprise, therefore, that physicians have invented so many means of cure to preserve health and to combat disease. Nature maintains life by simple processes. A few contrivances serve her for the preservation of health, nor are the causes of disease many. It is justifiable, therefore, to assume that the remedies to be used in restoring health should be neither complicated nor numerous. Indeed, we may not only assume, but I most positively affirm (and it may be put down to the misfortune or

abuse of therapeutics), that the mass of medicaments and elixirs found in the works of both ancient and modern physicians have had no other purpose than to impede the art of healing, and to make it uncertain and deceptive. Certainly the medicines by means of which the physician can support the efforts of nature, achieve success, cure the sick, and win honor for himself, are by no means numerous. There are many things which, though they appear to have little influence in the healing of disease, or the preservation of health, yet possess unthought-of power. Of this kind are those six matters called the non-natural,[1] whose intelligent application may be of the greatest service in the art of healing without medicaments. We have an example of their power in the influence of movement and in the exercise of the limbs. The influence of exercise is so strong—if we can believe the testimony of the ancients and our own experience—that where disease is to be prevented or cured it is to be prized more than the most costly medicaments."

"I undertake the following work," Hoffmann continues, "in order, with the help of God, to sift this question thoroughly, and to determine as clearly as I may, what are the useful and what the harmful influences of exercise, and in what way they are capable of promoting health or checking disease."

But to return to Ling. If we ask wherein his peculiar merit lay, we find that he reëstablished the gymnastics of the ancients on a scientific basis, and using the then known results of skilled German gymnasts, penetrated still deeper into the writings of ancient nations, and became one of the first to elaborate a complete system on an anatomical and physiological basis.

In gymnastics, like in art, various schools have arisen, such as the Swedish, the German, and the English. All these, by various means, strive to achieve the same end, and as no branch

[1] Before the modern discoveries in anatomy, physiology, and pathology, three kinds of matters were recognized in regard to the human body: the natural, the non-natural, and the contra-natural. Of natural matters there were six—*i. e.*, the temperaments, the humors (chyle, blood, lymph, bile, urine, and feces), the vital and animal spirits (nervous fluid and æther), the solid and fluid substances, the functions of organic and animal life, and the elements (earth, air, fire, and water). Of non-natural there were likewise six: air, food, motion and rest, sleeping and waking, the passions, and those substances retained or excreted by the body. In the contra-natural were included disease, with its causes and symptoms.

of science recognizes an end to its possible advance, in medico-gymnastics, also, new methods are constantly being developed. The pupils of Ling and their disciples spread the new doctrine and methods through Germany, England, France, and Russia. By the middle of this century already we find gymnasial institutions presided over by skilled instructors, scattered throughout all these countries, and from this period, too, date a number of the larger works on kinesitherapy.

In Sweden there were Branting, Georgii, and Sonden; in London, Indebeten, Bishop, and Roth (an Austrian by birth); in Germany, Rothstein, Neumann, Eulenburg, E. H. Richter, Koch, Hartwig, Berend, A. M. Böttcher, and others; in France, Becquerel, Sée Blache, Hervieux, Piorry, Dally, Laisné, and others.

In Austria (Vienna) there was at that time but a single individual who interested himself in the subject. This was Dr. Melicher, who had studied with Branting in Stockholm, and with Georgii in London.

Although the extravagancies indulged in by some of Ling's pupils may have brought upon the new system some discredit, still they could not affect its lasting principles. Such eccentricities as are found in Neumann's work, *The Therapeutic Limits of the Movement Cure*, in which he affirms that even such tenacious hereditary diseases as carcinoma and phthisis may be removed, simply deserve the silent disregard of the scientific world.

Ling and his pupils devoted themselves chiefly to active and passive movements. Mechanical manipulations such as were first employed in France, between 1850 and 1860, under the name of "massage," were but little used by them. The French literature of that time on the subject is chiefly concerned with the mechanical treatment of ecchymoses, contusions, and dislocations; and the works of Elleaume, Rizet, Magne, Lebatard, Quesnois, Servier, and Millet have contributed more to the surgical than to the medical aspect of mechano-therapy. Nevertheless the work of Estradère (1863) must be looked upon as marking an epoch in our knowledge of this subject. He presented it as a thesis for the degree of doctor of medicine, and it may be credited with the honor of having been the

model for a number of later publications. It is rather singular, however, that this excellent work, so often quoted, is scarcely to be found outside of the libraries of French medical institutions.

Up to 1870, the literature of mechano-therapy was represented by only a few large works or magazine articles; this arose from its practical application throughout the whole of Europe, with the exception of Sweden, being limited to a few specialists.

The results, often bordering on the miraculous, obtained by these specialists, however, particularly in surgical cases, soon attracted the attention of men eminent in the profession. An interest began to be felt in "massage" in the different German surgical clinics, and pains were taken to determine its indications and to develop its methods, and the success attained naturally contributed largely to extend the new system. Nevertheless, there was still considerable tendency to ascribe the cures, especially in cases which had been considered incurable, to some obscure or ill-understood influence, or to chance, self-deception, or even to fraud. As recently as 1875, Billroth published an article in which, while acknowledging the successes obtained in his clinic by massage, he yet expressed his doubts whether neurosal arthropathies could be successfully dealt with by mechanical means.

The literature on the subject had, until then, consisted chiefly of recorded observations confirmatory of statements previously made by others, and was made up of either discussions of cures of single cases, or explanations of general methods, in which, however, the *jurare in verba magistri* became the universal rule. Still, each of these publications had the merit of helping to introduce the knowledge of mechano-therapy to the medical public at large.

The first treatise on mechanical manipulations, physiologically considered, appeared in 1876, in Langenbeck's *Archiv für klinische Chirurgie*, and was the work of von Mosengeil, who described some very instructive experiments made by him on rabbits. It was through this work that mechano-therapy emerged from the obscure mists of empiricism to step out into the sunny fields of scientific research.

The total number of magazine articles and pamphlets from all sources up to 1874, amounted to from one to four a year. In 1875 there were five; in 1879 as many as nineteen publications in various languages appeared. This noticeable increase shows what a general interest in the subject was being taken by the profession, whilst its adoption in the principal European clinics gave it a scientific standing. Its popular appreciation, as well as a recognition of its aims and its accomplished successes, was shown by the erection of institutions for sanitary gymnastics in all the larger cities, and its introduction into all the then existing hydropathic establishments.

During the past few decades it has gained an established place in all works on general therapeutics (as in Rossbach's *The Physical Methods of Healing*, and the article by Busch in *Ziemssen's Handbook*[1]). In future, no treatise on ophthalmology, gynecology, neurology, or on digestive or circulatory disturbances, will be without a chapter on its appropriate form of massage.

It is a curious fact in the history of sanitary gymnastics, that while in Sweden, Germany, Austria, Russia, England, and America, many eminent scientists are seeking to further its progress by both word and deed, in France, where, twenty years ago, so much activity was displayed in this field, and so many valuable ideas brought to light, at present it is the exception either for a clinician to prescribe mechano-therapy, or for any physician of scientific attainments to busy himself with it. Indeed, the very term "massage" is in bad odor, it being associated in the public mind with a suspicion of quackery. It is not that the potent effects of the movement-cure are unrecognized in France, but it lies, unfortunately, at present, under the ban of public opinion, which will require all the magic of some great and recognized scientific authority to dispel.

[1] Ziemssen's Handbook of General Therapeutics. General Orthopædics, Gymnastics, and Massage. By F. Busch. Translated by Noble Smith. New York, William Wood & Co.

CHAPTER I.

Definition of the word "massage." Reasons why mechano-therapy has not become the common property of the profession. Can massage be learnt without a teacher? To what extent can the general practitioner busy himself with massage, and how much must be left to the specialist? Can laymen be employed as mechano-therapists? Can the human hand be substituted by apparatus? Conclusions.

DEFINITION OF THE WORD "MASSAGE."

THE word *massage*, derived from the French *masser*, to knead, literally means, a kneading. Yet kneading is only one of the many manipulations used; and there are diseases in which —to adopt the popular term—massage is used without any real kneading whatever taking place. Kneading presupposes the fingers actually pressed into the part manipulated. This occurs whenever soft tissues, as muscles, are manipulated; but where treatment involves some bony resistent part, as in frontal or supramaxillary neuralgia for instance, kneading is out of the question. Here we can only speak of stroking, or, at most, of stroking accompanied by pressure. When a sprained and swollen ankle is subjected to "massage," there can, of course, be no question of true kneading, for it would be next to impossible to press the fingers into the tense and distended tissues. Here, too, the expression stroking combined with firm pressure would best convey our meaning. The process known as "fulling"[1] will give a good idea of this manipulation.

In treating diseases like sciatica, brachial neuralgia, torticollis, chorea, and muscular rheumatism, not only are all forms of massage brought into use, but passive and active movements play an important—often the most prominent—part. Indeed, without muscular exercises other than pure "massage" a cure would hardly be possible in this class of cases.

[1] A term used by cloth-weavers to express a certain manipulation of the cloth accompanied by rubbing.—TRANS.

The term massage, therefore, by no means embraces all that is included in mechanical therapeutics. Nor does the term *manipulations thérapeutiques*, used by some French authors in place of the unpopular word "massage," entirely express the method of treatment, for active muscle exercises cannot be classed as manipulations.

To get around the word, Rossbach, in his excellent book on the subject,[1] has given to the chapter corresponding to "massage" in other works, the heading "Stroking and Kneading," but in his fourth paragraph he mentions tapping and beating as among the principal manipulations of this method, and in paragraph five, passive movements. His designation, therefore, is likewise unsatisfactory. It would seem really desirable if a better and more general designation could be united on. To me, the term *mechanical treatment* seems to be all-comprehensive, for active as well as passive exercises can be included under it. The word "movement-cure"[2] used by Busch in his excellent article on this subject in *Ziemssen's Handbook* would be very appropriate; nevertheless, he chose for a title "Gymnastics and Massage."

WHY MECHANO-THERAPY HERETOFORE HAS NOT BECOME COMMON PROPERTY OF THE PROFESSION.

The time was when reputable physicians scrupled to busy themselves with mechanical treatment, or, if they did, hesitated to commit to paper their ideas on the subject, or to contribute, by clinical observations, their mite toward spreading this now no longer new method of cure. That day happily is passed, and mechano-therapy may be said to have received its formal scientific consecration at the hands of such men as Billroth, Benedikt, Charcot, Eulenburg, Esmarch, Hervieux, Hüter, Gradenigo, Gussenbauer, Nussbaum, Pagenstecher, Piorry, Trousseau, Winiwarter, and others, and to-day the most eminent physicians do not for a moment hesitate personally to treat disease by manipulations. The mechanical treatment of

[1] Lehrbuch der physikalischen Heilmethoden, II. Heft, Berlin, 1882.

[2] It is, perhaps, hardly necessary to note that this is the term most frequently used by English-speaking authors.—TRANS.

a patient suffering from sciatica is certainly not more fatiguing than operating for vesico-vaginal fistula, where the operator is often constrained to remain from one to two hours in a most tedious and uncomfortable position. It was formerly customary to assert, with an affectation of superiority, that it would hardly be possible for a regular physician to condescend to use a means until then only in vogue with quacks and female "rubbers." But as quacks prescribe all sorts of medicines too, this objection can hardly be considered a valid one. Surely, the writing of a prescription, which is but too apt to reveal small diagnostic acumen and even less knowledge of drugs, does not require more intelligence than the mechanical treatment of sciatica, which cannot be undertaken without a knowledge of both anatomy and physiology. Prescription-writing often gets to be a matter of routine, requiring in time but little exercise of the intellect. The mechanical treatment of writer's cramp, chorea, or neuralgia, on the other hand, presents numerous and interesting modifications, all of which have carefully to be considered and which constantly present new incentives to the inventive powers.

He who in mechano-therapy keeps only the mechanical part in view, is on the wrong track. He must proceed like a machinist, who constructs a machine on the basis of his knowledge of mechanics and physics. In mechano-therapy, however, as in most other fields, empiricism preceded scientific research. Priessnitz, a peasant of Gräfenberg, cured thousands by the use of cold water, long before physiologists had demonstrated the thermic and vasomotor effects of this simple means. And it took many years before cold water attained a prominent place among therapeutic measures, or even before the medical world became convinced of its powerful effects. Empirics also have for centuries successfully used mechanical means in the treatment of certain diseases, but only within a comparatively short time have educated physicians deemed it worth their while to investigate the matter and subject it to physiological tests, divest it of all mystery, and reduce the cures to a scientific basis.

When we consider that the literature of the subject has now attained very respectable dimensions, and comprises excellent

magazine articles, admirable dissertations, and even voluminous tomes, and that, in spite of all this, mechano-therapy has heretofore not become the common property of the medical profession, we naturally ask ourselves, Why is this so?

First of all, it is because every new idea forces its way but slowly into acceptance. Mankind is prone to cling to what is old and is, as a rule, too indolent to test novelties. Self-interest, too, sometimes prevents our adopting a new form of treatment, for as the physician cannot, even with the best known remedies, promise a certain cure, the general public would certainly be inclined to hold him culpable if he failed when resorting to something novel and unusual. What difficulties has not the country practitioner even yet to encounter in applying the cold water treatment in typhoid fever, despite the fact that since its introduction the mortality from this disease has, from being thirty-five per cent., sunk to eight per cent.

One reason, probably, why mechano-therapy has not found a more general introduction, is due to the absence of a thoroughly practical treatise on the subject, explaining the different manipulations, often difficult to describe, by numerous illustrations. To illustrate the importance of drawings, I will give the following instance as an example:

In a recently published work, Schenkl[1] says: "According to Pagenstecher, massage is performed by grasping the upper or lower lid (according to the seat of the disease), with the thumb near the edge, and rubbing it against the eyeball."

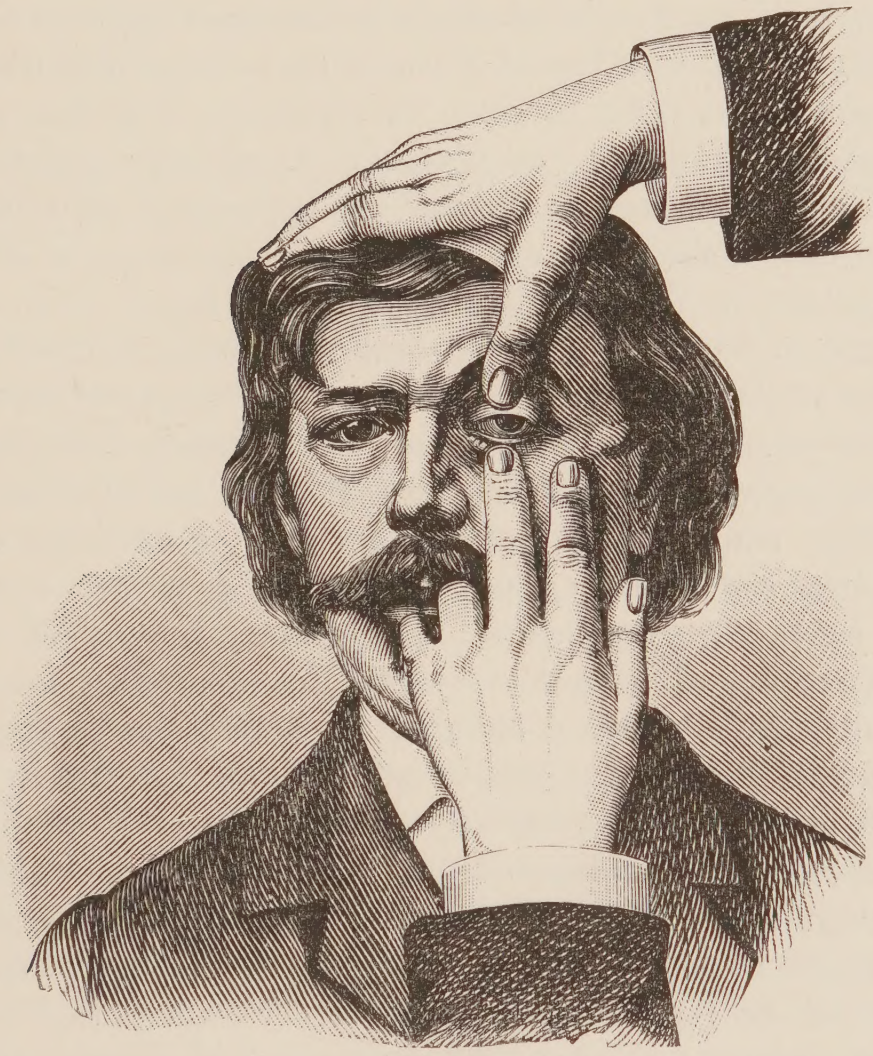
The interpretation of this paragraph might puzzle many readers, and I am convinced that many physicians wishing to employ this manipulation would not know how to go to work, simply from being led astray by the word "grasp." What Pagenstecher really meant to convey was that the lid should be steadied with the thumb and then pressed against the eyeball. One cannot properly speak of "grasping" anything with one finger; the idea presupposes the use of, at least, two fingers, which hold the object grasped.

This drawing (Fig. 1), however, which Dr. Schenkl has

[1] Schenkl: "Recent Therapeutic Experiments in Ophthalmology," Prager med. Wochenschrift, No. 30, 1882.

kindly given me permission to reproduce, at once clears up any doubts as to how the fingers are to be used in this manipulation, and any one can see, at a glance, what Pagenstecher meant by the word "grasp."

Fig. 1.



Even where no faulty diction leads to error, it is often difficult to perform a certain manipulation from its description alone, if it be not illustrated.

Perhaps another reason why mechano-therapy is not in more common use lies in the fact that its methods cannot be learnt without the expenditure of much time and trouble, and this brings us to a question which we deem worthy of a more extended discussion.

CAN MASSAGE BE LEARNT WITHOUT A TEACHER?

Until quite recently, it has been the custom to affirm that one could only become a mechano-therapist by being instructed by others. I may, however, claim for myself the small credit of having been the first to show, in an address delivered before the fifty-fourth meeting of Natural Scientists (Naturforscher-Versammlung), held, in 1881, in Salzburg, that this opinion is erroneous, and that the necessary knowledge and skill can very well be mastered without an instructor, if, with each manipulation, the final end, namely the physiological effect, be kept strictly in view; while, on the other hand, mere slavish imitation of the description of some procedure, even when carried out to its minutest details, will never lead to success.

Descriptions and explanations are, of course, indispensable, but every practitioner of mechano-therapy deviates insensibly and often considerably from the original directions; just as an experienced surgeon, though following generally prescribed rules, yet performs an operation in his own individual way.

Anyone devoting much time to mechano-therapy will fall naturally into methods peculiar to himself. Given a particular case, and different physicians, all, perhaps, equally skilled in the art, will proceed each according to his own method, yet the various means adopted will all attain the same end in view. The beginning only is difficult, and confidence in the method will at once be acquired by the cure of a single case; especially of one before regarded as incurable. No mere routine must ever be allowed to replace the application of those anatomical and physiological principles which must be our guides in the treatment of every case.

So far as self-teaching is concerned, almost involuntarily the question occurs: How did the first practitioners of the method begin? Who taught them? Certainly, only their own endeavors. It follows, therefore, that any physician may acquire the methods up to a certain degree of perfection, merely by study and reflection. Nevertheless, special instruction, or often the simple observing of others, greatly facilitates the progress of a beginner. Obstacles will be sooner overcome,

and doubts and difficulties more easily removed, besides much useless experimentation is saved. The fact also of being constantly encouraged and stimulated in one's task by the advice of some experienced physician, is no small gain. In addition to all instruction, however, a certain inborn mechanical dexterity is indispensable, and it is very evident that there are numbers of physicians whose whole nature unfits them for this kind of practice.

TO WHAT EXTENT CAN THE GENERAL PRACTITIONER USE MASSAGE, AND HOW MUCH MUST BE LEFT TO THE SPECIALIST?

The determination of this question seems to me of considerable importance, for let it be once clearly settled and the beginner will not only be saved many failures, but he will also be prevented from unjustifiably condemning the whole system. Every physician, in the smaller towns, at least, is obliged to practise a certain amount of surgery, ophthalmology, laryngology, otology, etc., yet in all cases requiring special experience and skill he summons the aid of a specialist. He should act in the same way in regard to mechano-therapeutics. Every practitioner ought to be able to open an abscess, to catheterize, to bleed, to reduce a fracture or a dislocation, to treat a conjunctivitis, to make an application to the vocal cords, or to introduce the Eustachian catheter; but, as a rule, he would hardly undertake to perform amputation of the thigh, extract a cataract, extirpate a laryngeal polypus, or trephine the mastoid process, even if for no other reason than the impossibility of obtaining the necessary assistance for himself, or the care and nursing required for the patient.

In applying mechanical treatment similar conditions obtain. After a little study and practice no physician should have any trouble in treating a sprain, an acute muscular rheumatism, or a mild brachial neuralgia, but he will hardly have either the facilities, dexterity, patience, or time to treat a sciatica of years' standing, or writer's cramp, or confirmed constipation, or marked chorea. A specialist will, in all probability, be required for the treatment of this class of cases. A

specialist will not be discouraged by the apparent lack of success in the beginning (often extending over months), and he has, besides, apparatus which facilitates the cure, or may indeed have an establishment at his disposal wherein trained assistants devote all their time and energies to this subject alone.

It is often said that a busy practitioner has no time to give to mechanical treatment. This is, however, a mistake. The more difficult cases, requiring much time, he would, as it is, recommend to specialists, but many of the milder cases do not require as much time as attending a confinement case, dressing a wound, making an ophthalmoscopic examination, or applying a plaster splint; yet every physician is expected to find time for all these things, and as often, too, as occasion demands. To go still further, the mechanical treatment of acute muscular rheumatism or of a recent neuralgia takes decidedly less time than any other method, for while many days and even weeks are often consumed trying all sorts of medicines, a cure might have been effected in these cases by mechanical means at a single sitting.

It has sometimes been objected that the mechanical method requires a degree of bodily strength such as every physician cannot command. This assertion, however, needs to be qualified. I admit that many manipulations require considerable muscular power for their accomplishment, and especially a steady hand, and in treating a dislocated ankle or an inveterate neuralgia, many physicians might experience great fatigue. Such physicians must necessarily give up the idea of becoming mechano-therapists, but, so too, as we have seen, must he who is, by lack of natural dexterity, unfitted for the task. Experience, however, has shown me that the strength of the manipulator increases with practice, or, to put it another way, that the experienced physician does not tire so soon, because in becoming more expert he learns to husband his muscular power.

CAN PERSONS, NOT PHYSICIANS, BE EMPLOYED IN MECHANO-THERAPY?

Professor Schuh, the celebrated surgeon, had an orderly at his clinic, of the name of Vasali, who secretly gave courses in operative surgery in which, it is said, he used to ligature all

the large arteries with his eyes shut. Anton, the well-known servant of the great Rokitansky, knew how to hold his own on the significance of pathological appearances against many a professor. I think these instances will be answer enough to the above query. There can, indeed, be no doubt that an intelligent layman can master the numerous manipulations which are used in the mechanical treatment of disease. The instances mentioned above need, perhaps, a few words of explanation. Vasali had, in the course of twenty-five years, seen thousands of operations at the clinic, and had attended dozens of operative courses; and old Anton assisted at no less than seventy thousand autopsies made by his great master.

Much experience and hard study should be required of a layman before he is entrusted with the full treatment of a case. The different manipulations are in themselves, not difficult to learn, if only the necessary regard be paid to the relations existing between bone and soft parts; but the active and passive movements so indispensable for the cure of certain forms of disease require an exact knowledge of anatomy and physiology for their proper performance. These, therefore, should always be performed by the physician himself, or at least under his direction and oversight.

CAN THE HUMAN HAND BE SUBSTITUTED BY APPARATUS?

Many devices have been invented for saving the manipulator's strength, such as Klemm's muscle-beater, the elastic rods with rubber balls of Graham, and the machines run by steam of Zander. All these are well enough in their way for treating certain phases of disease, but in general they may be said to be wholly inadequate to our needs, and are quite apt to degenerate into mere playthings. No better results can be obtained than with the practised hand, which surpasses even the best of instruments, and the skilled operator needs no other aid, no matter what kind of manipulation he may wish to perform. In the fingers, the fist, the edge of the hand, and in the forearm and arm, we have an armamentarium possessed of the greatest variety of effects, for their use is capable of infinite multiplication by the variously graded force with which

they may be employed. On the other hand, in executing passive and active muscle exercises, apparatus can be used to the advantage of both patient and physician. Indeed, without it, treatment would often be rendered far more difficult. Nevertheless, it is possible to dispense with special apparatus, and by employing instead, such household furniture as may be at hand, still attain one's end and effect a cure. The physician will have frequently an opportunity to display on these occasions his ingenuity and intelligence.

A detailed account of the apparatus used will be given in the chapters on the treatment of the separate diseases.

CONCLUSIONS.

I think, from personal experience in the matter, I am justified in laying down the following:

1. Every physician having the inclination and ability, no matter where he may practise, may acquire, self-taught, and successfully employ the methods of mechano-therapy in the treatment of disease.

2. The absence of apparatus such as is generally found in regular establishments is no insurmountable obstacle to success. It may, only render the application of the system a little more difficult, and perhaps retard the cure somewhat.

3. Old and chronic cases, requiring special means, special experience, and special treatment, are best referred to the establishment of some specialist.

4. Laymen, by instruction, and by observing others, may be trained to perform all the various manipulations, but allowing them the independent treatment of a case is not always without danger to the patient.

CHAPTER II.

Physiological, primary, and secondary effects of mechanical interferences. Evolution of heat in muscles as a result of mechanical concussion.

PHYSIOLOGICAL EFFECTS OF MECHANICAL INTERFERENCES.

These may be divided into two groups:

1. Primary (purely mechanical) effects—*i. e.*, the removal of lymph, exudations, transudations, and extravasations, the destruction of exudations by pressure, the removal of vegetations by frictions, and the solution and removal of adhesions.

2. Secondary effects; which act by increasing the circulation by stimulating the muscular and nervous systems, by setting up molecular changes, and producing consequent changes in sensation, and by effecting alterations in the processes of general nutrition.

I. Primary (purely Mechanical) Effects.

If any portion of the body be forcibly stroked in a centripetal direction, acceleration of the lymph and venous currents occurs in the part. The reasons for this arise from the anatomical arrangement of the lymphatics and veins. The capillary lymphatics originate as stomata in the lymph-spaces of the tissues. They have, besides, openings in their continuity communicating with the lymphatic canaliculi. These openings absorb from the tissues the lymph—which is nothing more than the plasma of the blood after it has parted with its nourishing ingredients to the tissues—and carry it to its ultimate destination. A reflux of lymph toward the periphery is prevented by valves similar to those in the veins. The accelerated flow of lymph in the part which has been pressed or stroked has also a secondary effect, as it allows the mechanically emptied vessels more readily to absorb the fluid newly

exuded from the capillaries. We see that stroking and pressure, therefore, act like a pump to the venous and lymphatic vessels. The reason that active or passive movements are such valuable accessories to the different manipulations, arises from the fact that by compression of the vessels muscular contractility likewise hastens the lymph and blood current.[1]

There can be no doubt that exudations and transudations, when accessible to mechanical treatment, may, by repeated pressure, be finally disintegrated and liquefied, and in this state forced into the lymphatics in the tissues. Even old exudations of years standing and of firm consistency, are frequently removed in this way. Mosengeil's[2] exceedingly instructive experiments have shown how rapidly and powerfully mechanically induced resorption acts. He has expressed the belief that the cellular elements detached by massage are absorbed—consumed, as it were—and digested by analogous cells.

It is worth while to give here in detail one of his experiments:

At 9 A. M. he injected a hypodermic syringeful of India-ink into both knee-joints of a rabbit. The temperature in the rectum, immediately following the operation, was 100.8° F. At 9.30 A. M. the right knee was manipulated, the rabbit seeming unaffected by the operation, being quite lively and running about. At 9.45 A. M. both knee-joints were again injected with the same quantity as before, but with a less concentrated suspension of the ink, and the right knee was again at once manipulated. The pain seemed more intense with this injection than with the first; the rabbit resisted violently, and was hard to hold. The manipulation of the joint, too, seemed to be more painful. After manipulation, the knee, previously swollen, became of normal size again. It was noticed that the left leg, which, as a check experiment, had not been manipulated, was likewise less swollen after the rabbit had run about a while. At 3 P. M. injections were again made into each knee-joint, and the right knee manipulated as before. In two minutes the swelling of the right knee had disappeared, while the tumefaction of the left remained permanent. In the meanwhile the temperature had risen to 102.2° F., and at 8.30 P. M.

[1] Wundt: Lehrbuch des Physiologie des Menschen. Erlangen, 1873.

[2] Von Mosengeil: Langenbeck's Archiv für klinische Chirurgie, 1876, 9 Band, 3 and 4 Hefte.

reached 104° F. However, to judge from its hearty appetite, the animal did not seem to feel very badly. At 8.45 P. M. the knees were again injected. It was now found that a whole syringeful could no longer be forced into the left knee, but readily entered the right, which was again manipulated. On the following morning half a syringeful of a thick suspension of the ink was injected into each elbow-joint, both joints were manipulated, and the animal then killed and examined. In the upper extremities the ink was found distributed in irregular patches in the periarticular connective tissue about the puncture, and extending into the subcutaneous tissue, and also upward along the vessels and the intermuscular septa. The axillary glands of one side were found to contain India-ink; the lymphatics leading to them being intensely black. On the other side, on which a colleague had performed the injection and attempted the manipulations, no ink was found in either lymphatic vessels or glands.

In the lower extremities the condition of things was somewhat different, owing to the injections here not having been made immediately preceding the animal's death, but some little time before.

We see from this interesting experiment that it is possible within the space of a few minutes to remove a fluid injected into the knee-joint of a rabbit, by manipulations which force it into the lymphatics. It is true that von Mosengeil was unable to actually demonstrate an endothelial lining in the channels taken by the ink, but the mere fact that a certain definite course was in each case taken speaks strongly for their preëxistence.

Since the pain in an inflamed area is caused by the pressure of some exudation upon sensory nerves, relief from pain will follow in proportion to the removal of this pressure, and we may, therefore, claim *analgesia* as one of the effects of mechanotherapy. An *antiphlogistic* effect is also produced, inasmuch as by manipulation the lymphatics are emptied, tumefaction disappears, and with it heat and redness. By accelerating the lymphatic and hæmic circulation, accumulation of fluid may be prevented; or, if already present, may be removed. Thus the *power of causing resorption* is another of its effects.

II. Secondary Effects of Mechanical Interferences.

The most important effects of mechano-therapy correspond to those produced by electrical or chemical stimuli on the vasomotor nerves and muscle fibres, namely, in the first instance dilatation and contraction of the arterioles, and, in consequence, increased absorption and nutrition; and, secondly, muscular contraction.

Innervation of the bloodvessels occurs, as is well known, in two ways. First, by parietal ganglionic centres; and, secondly, by extrinsic nerves whose stimulation has a direct influence on the lumen of the vessel.

If the effects of mechanical interference on a vascular area be studied microscopically in some transparent tissue, as the mesentery or the interdigital web of a frog, it will be observed that, as a rule, there is at first a contraction of the arterioles, which at times amounts nearly to an obliteration of their lumina. This contraction is often of very short duration, and is succeeded by a dilatation lasting over a considerable period, during which the current of blood is retarded in the whole vascular area involved, but especially in the capillaries, so that diapedesis of white and sometimes even of red blood globules may be observed to occur.

According to Claude Bernard, this dilatation may begin immediately upon the application of the stimulus. We infer, therefore, from the phenomena observed, that the walls of the vessels, like those of the heart, contain both an active motor and an inhibitory nervous apparatus.

Besides reacting to direct stimuli, the vasomotor nerves may be affected reflexly also through the sensory nerves. As a rule, the vessels of parts whose sensory nerves have been stimulated become dilated; the vessels of the ear, for instance, dilate after stimulation of the auricular nerve, and the vessels of the foot, after stimulation of the dorsalis pedis. The local distribution of blood is, therefore, constantly subject to change, in consequence of the contraction and dilatation of the arterioles resulting from either direct stimulation applied to the vasomotor nerves themselves, or indirectly to the sensory nerves; and the function of any organ, as the act of secretion by glands,

or the state of contraction of a muscle, is always accompanied by local hyperæmia. Should this reflex vascular dilatation become permanent, then the process changes to pathological hyperæmia and inflammation.

The increased temperature which is produced in the parts subjected to mechano-therapy is of material benefit in cases where, as a result of disease, diminished nourishment of the tissues, and consequent diminished temperature, has occurred. The cold hands and feet of chlorotic and anæmic patients are instances of this. Of all the organs of the body the nerves and muscles are most capable of being powerfully influenced by mechanical interference. Mechanical stimulus produces in them as well-recognized physiological effects as do chemical, thermic, and electric stimuli. In nerves (both sensory and motor), as well as in muscles, mechanical stimulation arouses a condition of excitation which, being transmitted by the nerves to glands and muscles, finally becomes evident in the phenomena of secretion and contraction.

The [central] nerve cells (ganglia of excitation) which are interpolated in the course of the motor fibres either conduct motor impulses uninterruptedly onward, or reflexly transfer them to more peripherally situated parts. From this arrangement the following combinations may arise:

1. The combination of one sensory fibre with another. The result will be sensation stimulation.
2. Of sensory with motor fibres. Result: reflex movement.
3. Of sensory with secretory fibres. Result: reflex secretion.
4. Of sensory with inhibitory fibres. Result: inhibition of muscular contractions or of secretion. (Inhibitory reflex.)

The mechanical stimulus bears more resemblance to the electric than to any other; like it, the effects called forth are proportionate to the intensity of the application. According to Valleix, compression lessens neuralgic pain, and pressure upon a muscle or nerve may, if gradually increased, be even carried to a point where crushing of the tissues occurs, without calling forth a contraction. On the other hand, a single sudden application acting upon a motor nerve generally calls forth a single contraction—tenanic contraction resulting only when a condition of extreme irritability exists. When the mechanical

stimulus is applied with rapid intermissions to the same spot on a nerve, tenanoid contraction results.

Schiff has shown that muscular tissue possesses a contractile power independent of that supplied to it by the nerves, and which persists even after death. This contractility he has called "idio-muscular." Its existence may be demonstrated by striking a muscle with some blunt edge, perpendicularly to the course of its fibres. A single blow upon a nerve produces in it a heightened irritability which rapidly disappears again, while more lasting alterations result when many blows rapidly following one another, act through the causation of a cumulative effect. The result of mechanical stimulation on nerves and muscles depends no doubt, in many cases, on the initiation of molecular changes in the elements of these tissues.

The effects of a blow upon the peripheral end of a (sensory) nerve are conducted to the nerve centres, and thence transferred to a motor nerve. This propagation of a mechanical stimulus can perhaps be explained by the formation of waves in the nerves, upon the theory of Fleischel, that the axis-cylinder of the living nerve is fluid in consistence.

The hypothesis, too, that certain nervous affections are due to molecular changes in the nerve elements finds some support in the fact that favorable results are obtained by such surgical procedures as exposing and stretching the nerve trunks, which possibly set up certain other molecular changes in the nerves. In mechano-therapy it is true the nerve trunks themselves are not directly pulled and stretched, but their thousands of terminal plates are subjected to every kind of mechanical manipulation. The chemical changes constantly taking place within the nerves may be looked upon as the outcome of molecular work, and as the expression of continuous molecular change.

When a mechanical stimulus operates upon a nerve it first induces in the latter a certain amount of latent energy, which being transferred to a muscle, there becomes manifest in the shape of work. The stimulus, however, is not always thus transformed, nor, when it is, need it occur at once. For nervous energy the result of molecular change, exists largely in a latent state, only part of it being manifest.

Nervous energy is the result of chemical changes occurring in the nerve tissues. And while of the energy so produced a small fraction is again utilized in chemical action for the purpose of reuniting the molecules necessarily disassociated, the greater part becomes free, and manifests itself either as mechanical work or in the shape of heat. Speaking generally, we may say that nervous irritability is any form of external energy, producing either temporary or permanent molecular disarrangement of the nerve elements.

Any source of energy conveyed to a nerve from without first expends itself in producing molecular change, and this is again converted into energy manifesting itself through the various forms of innervation.

This physiological theorem is of great importance for the proper understanding of the effects of mechano-therapy, and in the treatment of neuralgias it finds practical application.

The nature of the translation of molecular change into nervous energy has, so far, not been discovered. It may possibly be that the external (mechanical) stimulus increases molecular change, and that this causes at the seat of stimulation a greater disassociation of chemical molecules than would perhaps otherwise take place.

This translation into nerve energy proceeds somewhat on the principle of an explosion, in which, before the final outbreak occurs, there is a gradual accumulation of effecting causes. The recent experiments of Tigerstedt[1] indicate that the active energy of the stimulus is converted into a form of motion peculiar to the nerve substance; but exactly how this conversion takes place, and how it is that the most various stimuli all produce the same form of motion, are questions yet unsolved. Tigerstedt concludes that the normal functional activity of the nervous system consists of a species of wave-motion—thus coinciding with Hallstein, Wundt, Fechner, and Heidenhain.

For an intelligent comprehension of the means by which mechanical interferences act upon nerves and muscles, it will be necessary to glance for a moment at the most important

[1] R. Tigerstedt: Studien über mechanische Nervenreizung. Helsingfors, 1880.

physiological facts regarding the chemical changes occurring during nervous and muscular activity. We know but little about the metabolism of nerve-tissue, whether it be quiescent or active. That of the muscle, on the other hand, has been pretty thoroughly studied. According to DuBois-Reymond, the most prominent change occurring in the muscles in consequence of their functional activity, consists in the production of a free acid—probably lactic—and the acidity is proportional to the amount of muscular exertion. Other things being equal, also, it is greatest when the muscle, still stimulated to action, is prevented from contracting by a load. In the chapter on "Swedish Health-gymnastics" we shall again have occasion to refer to this fact.

In connection with the formation of acid, there is probably a simultaneous destruction of the carbohydrates, especially of the glycogen (Nasse and Weiss).

The proportion of fat, water, kreatin, and extractives increases, according to Sarokin and Ranke, while the nitrogenous bodies diminish somewhat in quantity, the changes being influenced by the respiration of the muscles. The experiments of Herrman, Ludwig, and Sczelkow show that an active muscle consumes more oxygen and produces more carbonic acid than a passive one.

According to A. Schmidt, the muscle while active produces also a larger number of readily oxidizable substances than when at rest. Still other experiments have shown that in the formation of carbonic acid in muscle besides direct oxidation, there occurs a splitting up of various substances containing oxygen in order to furnish the necessary amount of oxygen required. The increase in the consumption of oxygen and in the production of carbonic acid in the active muscle is, to a great degree, determined by the rapidity of its blood current, for Ludwig observed when he increased the rapidity of a current of warm defibrinated blood, conducted through an extirpated mammalian muscle retaining all its functional powers, an increased interchange of gases took place, even when the muscle was quiescent. An intimate connection probably exists between the fatigue of a muscle and the chemical changes taking place within it, for an intravascular

injection of lactic acid or of the acid potassium phosphate increases the fatigue of a muscle so treated. The revivifying influence of the blood current, therefore, acts not merely by carrying fresh materials, especially oxygen, for consumption, but by removing the effete products of combustion. For the nerves, according to Ranke, similar conditions obtain.

We see, therefore, what a marked effect the accelerated blood current, such as mechanical treatment produces, may have upon the chemical processes occurring in muscle- and nerve-tissue. Mechanical interferences also act reflexly through the cutaneous nerves. Thus, for instance, friction of the abdomen acts upon the hypogastric and solar plexuses, and, through them, upon the organs of circulation and digestion, which they control, stimulating the involuntary muscles of the stomach and intestine, and inducing uterine contractions.

It is a well-known physiological fact that heat is generated in muscle during contraction. Indeed, numerous experiments have shown that most of the combustion going on in the body occurs in the muscles. A muscle, even in quiescence, deprives the blood of its free oxygen, or rather of that existing in loose combination with the hæmoglobin. In a condition of activity this consumption of oxygen becomes increased five-fold. That mere mechanical vibration of a muscle is alone capable of generating heat, has been recently proved by the interesting experiments of Danilewsky. I think it worth while to insert here a short account of them, taken from Fick's[1] work, being convinced that it will form a valuable contribution to the practical aim of this book.

GENERATION OF HEAT IN MUSCLE DURING MECHANICAL VIBRATION.

Danilewsky made experiments to determine the rise of temperature experienced by a muscle when torn and vibrated by a falling weight.

He first experimented on inanimate objects. His apparatus consisted of two thin rubber plates connected by clamps to an elastic band. Between the two plates a thermo-electric pile

[1] Fick: Mechanische Arbeit und Wärmeentwicklung bei der Muskelthätigkeit. Leipzig, 1882.

was introduced; then, by means of a lever a weight was allowed to fall upon the rubber plates, throwing them into vibrations. The needle of the galvanometer was deviated, and a calculation showed an increase in the temperature of the rubber plates amounting to 0.0016° C.

This method he next applied to the living muscle of the frog, the thermo-electric pile being introduced between two muscles hanging parallel, side by side. Here too an increase of temperature after causing vibration of the muscle elements was demonstrated.

CHAPTER III.

Description of the mechanical interferences used. Stabile interferences: tapping; thrusting; hacking; Klemm's muscle-beater; pinching; squeezing. Continuous interferences: rubbing; stroking. Passive movements. Should the parts to be treated be previously oiled? Is treatment to be undertaken upon the naked or clothed body?

DESCRIPTION OF THE MECHANICAL INTERFERENCES USED.

THE number of different manipulations which have been used in mechano-therapy is exceedingly great, certain authors seeming to find pleasure in giving special names to each small modification of the principal manipulations used. Thus one reads of constricting, pulling, pressing, hacking, kneading, rubbing, stroking, tapping, sawing, squeezing, stretching, concussing, pinching, sticking, etc.

Estradère described no less than five varieties of tapping alone (*hachures*, *clacquements*, *vibrations pointées*, *vibrations profondes*, and *la palette*). But this elaboration and multiplication of subdivisions, which, by some authors, is carried even to a greater excess, is to be condemned as tending to discourage the beginner. Rossbach, in his treatise[1] on the subject, vigorously contests this useless differentiation in the chapter on "Stroking and Kneading." He says: "In the physiological division we have seen that it is merely a question of the propulsion of blood, lymph, and exudations from the periphery toward the centre, and certainly the processes of stroking, rubbing, kneading, and tapping will suffice to attain everything that can be obtained at all by this system. The urgent appeal to 'please to keep your inventions to yourselves,' may, therefore, with propriety be directed to all those ingenious inventors of trivial subdivisions." Everyone who has devoted any time to mechano-therapy will gladly subscribe to Ross-

[1] Lehrbuch der physikalischen Heilmethoden, p. 492.

bach's sentiments. I must, however, take exception to the remark that it is a question of the removal of exudations, blood, and lymph alone. In many diseases of the muscular and nervous systems it is of prime importance also to produce vibrations and to cause an evolution of heat—in other words, to bring about molecular changes in the primitive elements of the tissues in question.

While the complicated and circumstantial description of methods employed by some authors is a serious hindrance to the popularizing of mechano-therapy, still the manipulations required for the production of these molecular changes cannot all be embraced in the terms "kneading," "tapping," or "beating."

The various procedures cannot be too simply stated, however, for the beginner. I am convinced that any physician having the inclination and aptitude for this form of therapeutics will be able to invent for himself such minor modifications as are needed in the course of treatment, from the anatomical conditions, or from individual peculiarities, while descriptions and explanations which descend to trivialities will, at best, be of little use to anyone lacking the necessary natural qualifications for the work.

Before going on to a description of the different manipulations, I think it but right to mention that mechano-therapy, in its execution as well as aims, is a very different thing from that generally described as "hygienic massage." It has nothing in common either with those practices of the Greeks and Romans, which formed such an integral part of their baths and which aimed at the production of feelings of sensuality or of delicious ease, or with the manipulations used in the baths of the Orient, and now in general use throughout Europe, which simply afford for the bather a pleasant way of passing the time.

Savary,[1] in his letters from Egypt, in describing a bath taken by him there, speaks of the delightful feelings produced by passing through a series of apartments of graded temperatures, of being surrounded by scented vapors, of having his

[1] Extract from the letters of Savary on the baths of Cairo, in Phélippeaux's Etude pratique sur les frictions et le massage. Paris, 1870.

body scoured, pressed, and kneaded, and his limbs stretched, and his joints cracked, of being enveloped in clean linen, laid upon a soft couch, and having all parts of his body dried by the tender hands of children. When, finally, he mentions the coffee and tobacco which contribute to the pleasure of the massage, when he breaks forth in hymns of praise on the delicious feeling of sensuous ease produced by massage, when he speaks of the ease with which the blood seems to circulate, of the feeling of refreshment that ensues, and of the sweet sensations and delightful ideas that arise in the mind, and when finally he allows himself to declare that in fancy one overlooks the whole world, which seems to lie at one's feet and to grow more bright and refulgent under the observer's eye, and that everywhere only the laughing face of fortune is seen; all I can say is, that unfortunately mechano-therapy has nothing in common with these beautiful impressions and delightful sensations. It usually causes a good deal of pain and it is only in the popular acceptance of the term that the patient "sees stars."

After his daily manipulation the patient generally feels exhausted, often experiencing for twenty minutes or half an hour, pain which gradually disappears. The time for the repetition of his treatment is anticipated with fear and trembling, and only the conviction of its efficacy, or the fact that the cure has already begun and is visibly progressing, gives him courage and endurance to stand the torture imposed. In certain diseases, as constipation, neurasthenia, and chorea, it is true, there is no pain, or none worth mentioning, connected with the cure; in other cases, however, the pain experienced is so severe that patients cry out aloud, shed tears, and even vigorously resist the physician with arms and legs—a proceeding which must not, however, be considered as sufficient ground on which to base a charge of assault and battery!

CLASSIFICATION OF THE MECHANICAL INTERFERENCES.

As classification is always a help to beginners, I have attempted here to lay down the common characteristics of the mechanical interferences used.

They may all be divided into *stabile* and *labile*. The stabile act by a repetition of the application to one and the same spot, while in the labile the application is changed from one part of the affected area to another.

Stabile interferences may be represented by a blow against a solid body and by the propagation of the vibrations consequent thereto within this body. The labile resemble undulatory movements.

Among stabile interferences, are included: pressing, tapping (or beating), hacking, pinching, and concussing. As labile: stroking, rubbing, and kneading.

No exact line, however, can be drawn between the two, for, by a modification in their application, certain interferences may be just as well considered stabile as labile, or one form may pass into another; pressing, for instance, being often transformed into kneading and squeezing.

The skill shown in applying these various modifications and causing transitions from one to another constitutes the very acme of dexterity in mechano-therapy.

According to circumstances, passive motions may be classed in both categories. Active movements will receive special consideration elsewhere.

STABILE INTERFERENCES.

Pressing.

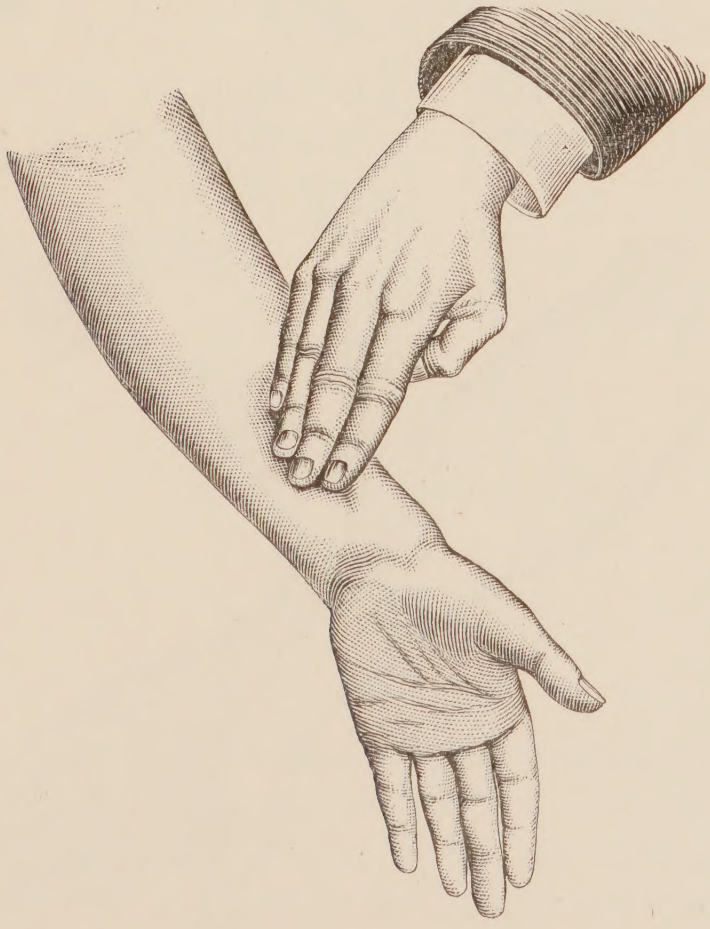
Pressure may be performed in a variety of ways; one, two, or three fingers being used, according to the size of the part to be treated, and the force which it is intended to use (see Figs. 2 and 3).

The participation of the little finger is only apparent, for, being two centimetres shorter than the ring finger, it cannot touch the part to be manipulated simultaneously with the others; its feebleness, too, would render it at best of little use.

The index finger, to be sure, is also shorter than the middle finger, but only by one centimetre, and it, therefore, more readily adapts itself to the middle and ring fingers. Of the different fingers, the thumb is of most use, owing to its short-

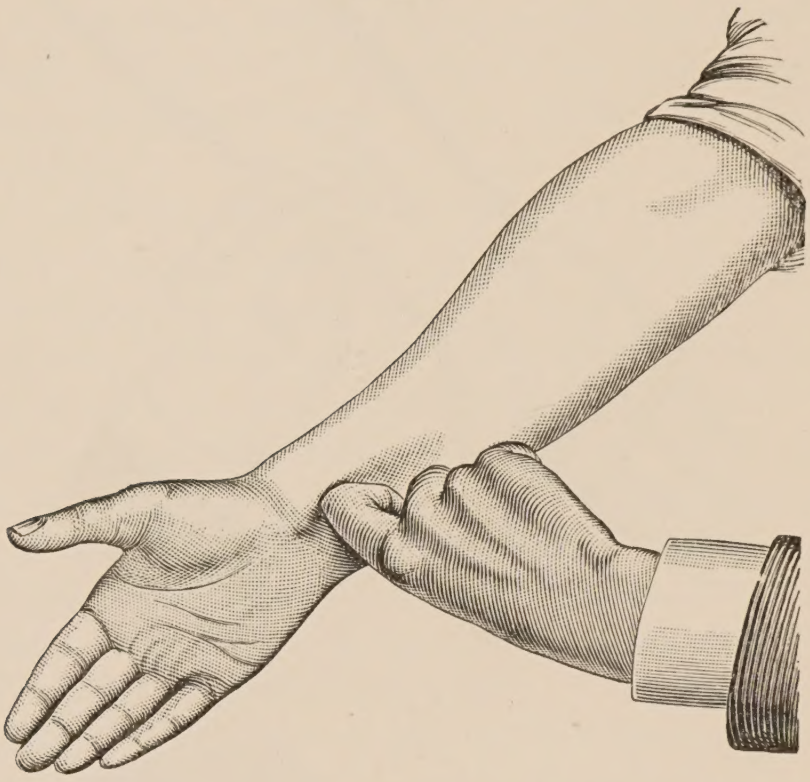
FIG. 2.

FIG. 3.



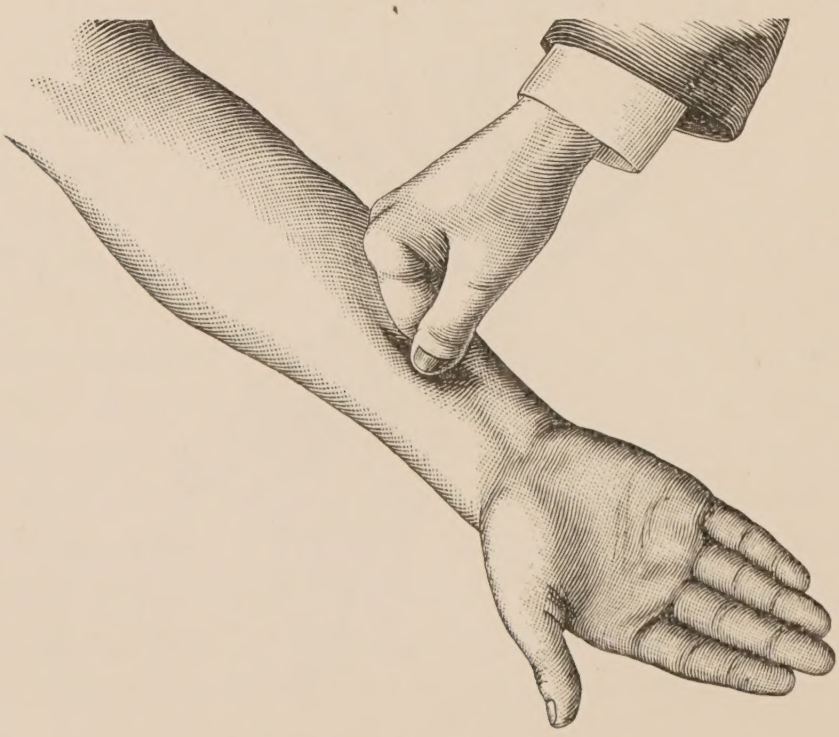
ness, strength, and to its possessing special muscles of its own (flexor pollicis longus and brevis, extensor pollicis longus and brevis, abductor pollicis, and opponens pollicis).

Fig. 4.



If the sensitiveness of the patient or the condition of the parts will not allow the finger-tips to be used, the second pha-

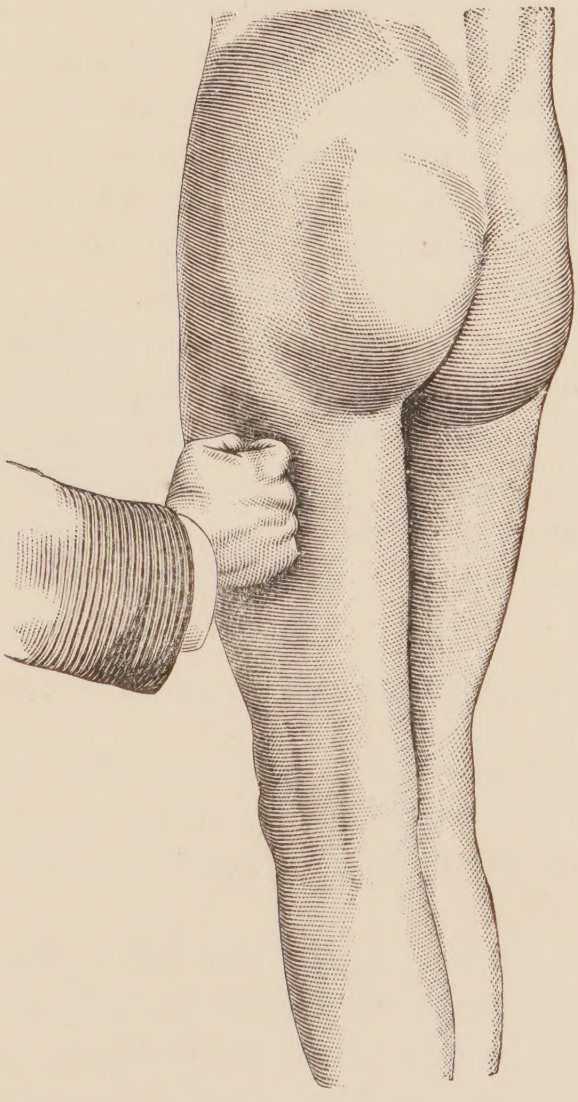
Fig. 5.



lanx of the index finger, or those of the index and middle fingers combined, may be used (Fig. 4), or three, or even four fingers may be associated in action.

The fact that the index and little fingers are not on the same plane is of no import in this mode of application, for the parts to be pressed are, as a rule, of irregular surface. Pressure can be increased by using, instead of the second, the combined third phalanges of the four fingers which form the fist (Fig. 5). Should still greater pressure be desired, instead of the surfaces of the combined first phalanges, the knuckles—*i. e.*,

FIG. 6.



the heads of the metatarsal bones—may be used (Fig. 6). Other things being equal, the pressure exerted is less the more joints there are between the shoulder of the operator and the parts of the hand used in pressure, for a large portion of the mus-

cular power brought into play must necessarily be used in the fixation of those joints. The term "other things being equal" needs a word of explanation. The amount of pressure depends a good deal on the position the physician takes toward his patient. In a sitting and standing posture the weight of the trunk can be used to increase pressure, and when the patient lies extended on a couch a maximum pressure can be obtained, for the whole weight of the trunk then helps to augment the muscular force.

Each mode of applying pressure, enumerated above, may be modified in three ways:

First, the fingers or fist used for pressing are caused to make slight lateral or rotatory movements (*vibrations* of the French).

Secondly, they are caused to move continuously from the point of application to some other spot—upward or downward—the stabile being thus converted into a labile interference by pressure being simply changed to stroking, the degree of pressure remaining the while unaltered.

Thirdly, they are caused to make very short continuous movements, during which pressure is first increased and then diminished. In accomplishing this the hand of the operator leaves each time the point of application to be applied anew—thus the procedure of "fulling" or kneading is evolved from that of pressing.

Tapping, Thrusting, and Hacking.

While pressing produces a constant effect, capable of every possible degree of increase or diminution, the three procedures just enumerated admit only of sudden effects of momentary duration.

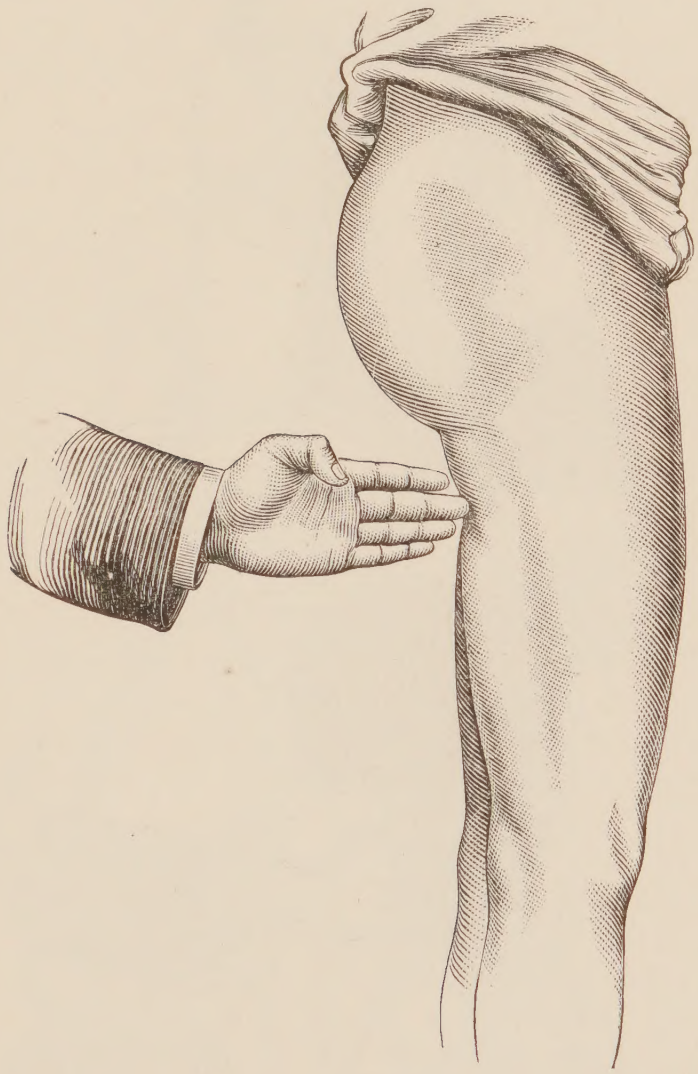
The operation of tapping (or beating) is done with the tips of the half bent fingers: the hand being moved at the wrist. It is only capable of producing mild effects, such as are used for neuralgias of the cranium.

Thrusting is performed with the finger-tips of the rigidly extended hand (Fig. 7), or with the clenched fist, the arm being moved partly from the elbow, and partly from the shoulder.

The patient may be either seated or standing, and the physician's hand impinges upon the body at a right angle.

This manipulation is useful where deeply lying parts, situated between groups of muscles, are to be reached, as in rheumatism and neuralgias in the larger muscle groups (as the buttocks and thighs), and also where marked effects generally are desired. Thrusting and tapping produce in the parts so

FIG. 7.



operated on a vibration or concussion which (in nerves) propagates itself from the periphery to the centre, and also molecular changes which are transferred from those on the surface to parts more deeply situated.

Of far more power and extensive application is the so-called muscle hacking, a procedure which is only employed when large groups of muscles are the seat of trouble, as in the neck, back, buttocks, thigh and leg, and arm and forearm.

FIG. 8.

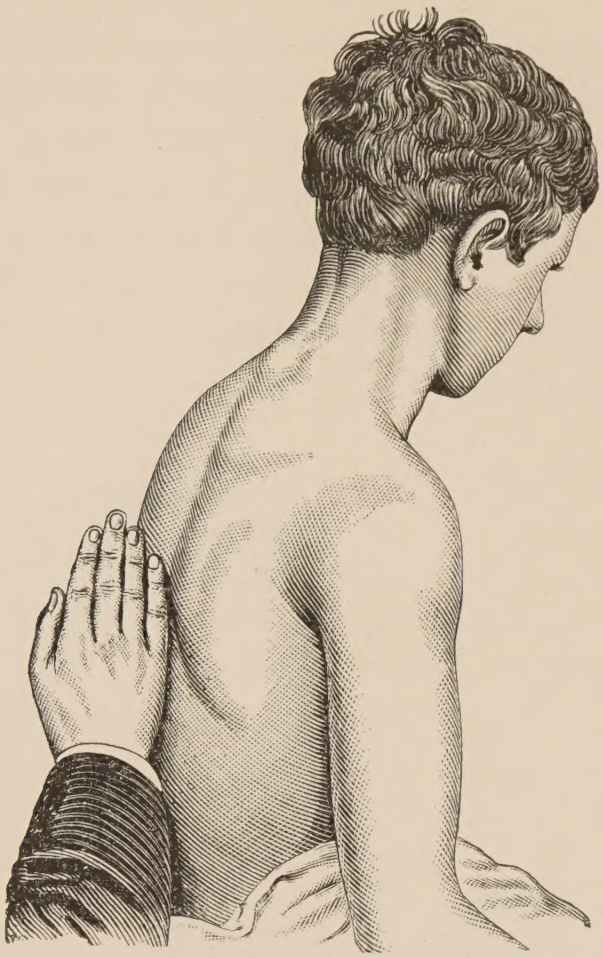
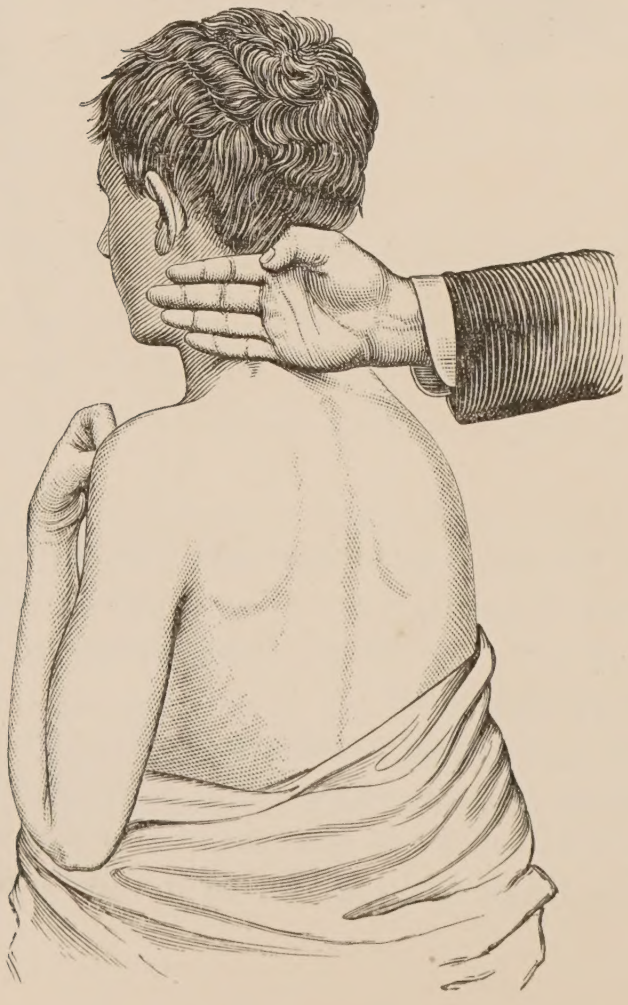
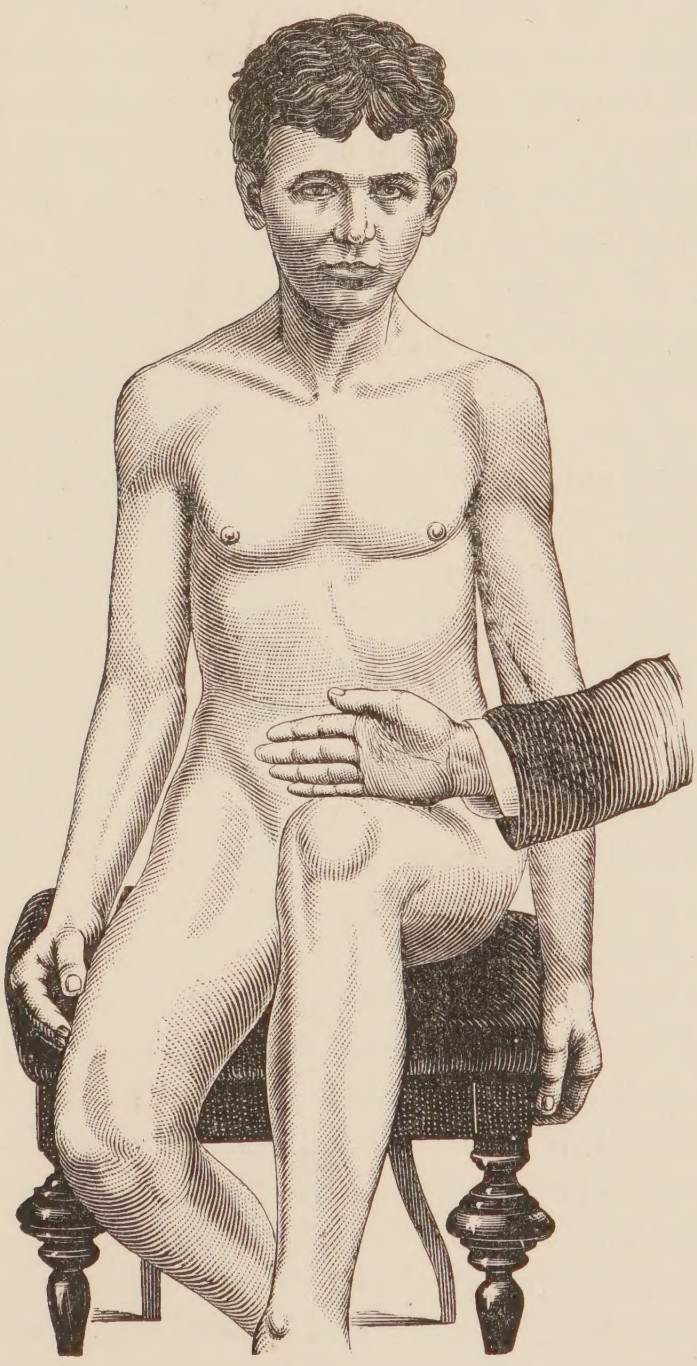


FIG. 9.



Hacking is performed with the edge of either the extended fingers or hand (Figs. 8 and 9), according as mild and superficial or powerful and profound effects are desired. In the first case (edge of the extended fingers) the motion originates in the

FIG. 10.



wrist-joint, the fingers being, as it were, flung against the patient's body, while in the second (edge of the palm) the motion proceeds either from the elbow or from the shoulder-joint. The latter manipulation allows of the employment of

the greatest amount of force, and is used on such large muscle groups as those of the thighs, buttocks, and neck (Fig. 10).

Klemm's Muscle-beater.

Muscle hacking should not be confounded with muscle beating, which is an incomparably milder procedure.

C. Klemm, director of a calisthenic establishment in Riga, first originated the very excellent idea of using for the manipulation of the skin (he would include the muscles as well) a number of thick elastic rubber tubes. These give the patient the great advantage of being able to manipulate himself, the services of an operator being dispensed with. The simple and effective apparatus known as Klemm's muscle-beater consists of three stout tubes, held together at one end by a rubber handle. They are made in three different sizes, each size differing from the others in the length and thickness of the tubes.

Fig. 11.

By means of this instrument it is possible for a patient to manipulate even those parts of the body ordinarily not easily accessible (Figs. 12 and 13). It is capable of effecting all the results produced by stroking, gentle pressing, and hacking. Powerful effects, such as vigorous hacking, forcible pressure, or pinching and squeezing produce, are as much outside the province of this elastic apparatus as they would be of the human hand were it hollow and elastic like the muscle-beater. At the part of the body operated upon with this instrument it is true, the weight of the blow will extend beyond the skin as far as the subcutaneous connective tissue, perhaps even to the layer of fat, possibly to the muscle immediately beneath, but to what an infinitesimally slight degree will the more deeply situated muscles be affected! Even using the greatest possible amount of force, it will, after all, be the skin which receives the brunt of the stroke.

In pinching, the fingers grasp the muscle in nearly its whole circumference; in pressing, the hand forces the muscle against its bony support; and in hacking, the edge of the palm pene-

trates by its bony framework into the deeper regions of the soft parts, and we should not forget, too, that these efforts can be maintained continuously for many seconds without the skin being subjected to any very sharp blow—all these are effects

FIG. 12.

FIG. 13.

which can be produced by the hand of the manipulator alone, and which can never be attained by any muscle-beater. Besides, in certain positions, as shown in Figs. 12 and 13, it is not possible to develop any degree of force.

Nevertheless, the muscle-beater (I would prefer the term "skin-beater") will be found of use in all those cases where superficial rather than deep parts are to be affected (as in the treatment of cold hands and feet, in rheumatism of the skin and superficial muscles, or in moderate stiffness of the joints). Much of its use lies no doubt in the bodily exercise to which its employment necessarily gives rise.

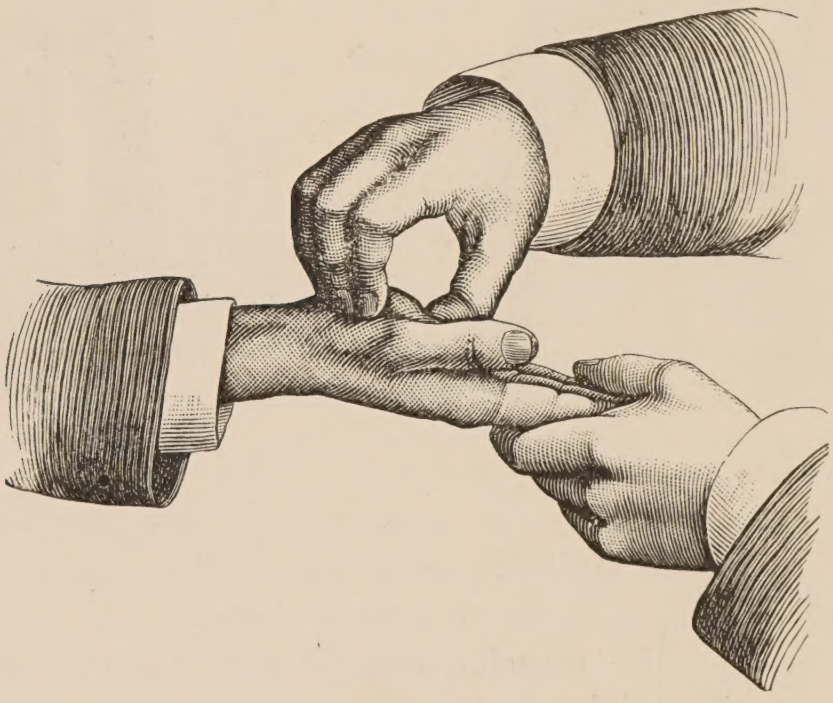
The pamphlet published by the inventor of the muscle-beater excites surprise by the use, in certain parts, of scientific language unusual in a layman. Other portions, again, give

evidence of very unsound medical ideas, for, according to Klemm, this instrument is capable of excellent service in the greatest variety of diseases; from muscular curvature of the spine to alopecia, and from gouty tophi to insomnia and dizziness.

Pinching.

In places where anatomical conditions permit of the soft parts being grasped, very powerful effects may be produced by pinching. There are two modifications of this manipulation. In the first of these, the thumb on one side and the four fingers on the other form, as it were, the jaws of a pair of pliers acting perpendicularly to the part operated on (Fig. 14). In the second,

Fig. 14.



the thumb and fingers are not applied with their tips, but with the balls of the last phalanges (Fig. 15), the first procedure being more powerful than the second. Of all the manipulations that have been, or are to be described, this one, in both its modifications, is the most fatiguing to the physician. It requires a very powerful thumb, and in performing it the fingers should be brought close together, for, when separated, less force can be exerted.

This manipulation is called *malaxation* or *pétrissage* by the French, and the following explanation is given : " The physician

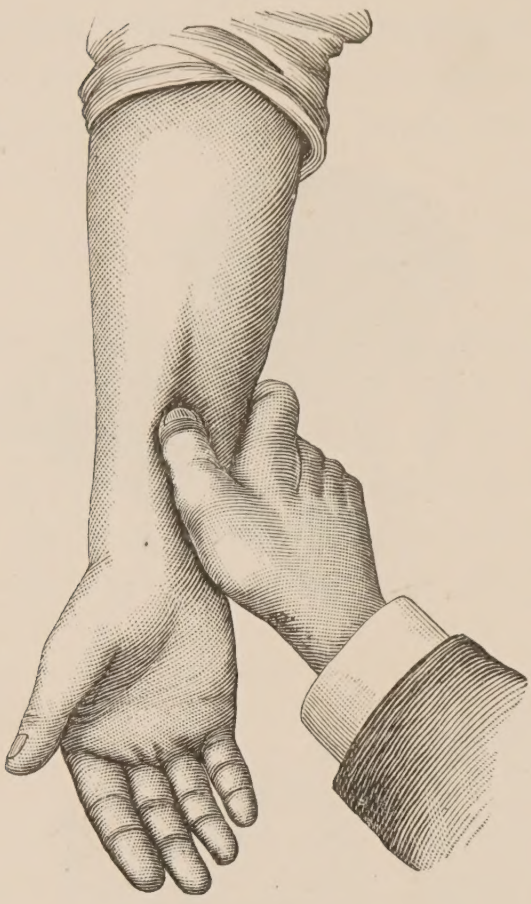
FIG. 15.

should treat the tissues of his patient as though he were kneading hard a bit of dough, or as though he were squeezing out a sponge saturated with water."

SQUEEZING.

Squeezing is but a species of pinching, for, while in the latter the jaws of the plier formed by the thumb and fingers act equally from either side, in squeezing the fingers remain passive, acting solely for fixation of the part, the thumb alone coming into play (Fig. 16).

Fig. 16.



Squeezing should, at first, be applied perpendicularly to the spot manipulated. Later, the thumb should be rubbed back and forth, with full force over the ganglion, gland, teno-synovial exudation, or whatever it is intended to squeeze.

LABILE INTERFERENCES.

Rubbing; Stroking.

That labile may be evolved from stabile manipulations we have already seen under the head of "Pressing."

Rubbing and stroking of affected parts with the palm is really nothing more than a gentle continuous pressing—*frictions simples* of the French. In the treatment of dislocations, in which these manipulations play as important a part, it is usually a question of the removal of extravasated blood and lymph from the part, and at the same time of causing the liquefaction and removal of semisolid coagula of blood and exudations. Firm compression, with a forward movement of the

hands, fulfils the indications. The hands should either encircle the limb like a band, or pressure may be made with the edge of the palm or with the inner edge of the index finger supported by the others. The French call this *frictions fortes à pleines mains*, or *massage proprement dit*, and it is this form of manipulation which has given the name to the whole system.

PASSIVE MOVEMENTS.

We understand, by this term, all movements performed by the physician upon the patient, the latter remaining passive. The following results are obtained:

1. Extravasations occurring about dislocated joints are, by pressing and rubbing the tendons and ligaments in which they are embedded, finally liquefied, and thus more quickly absorbed.

2. In stiffness of joints the contracted muscles and tendons are forcibly but gradually elongated, and any existing exudations or vegetations within the joints are disintegrated and absorbed.

3. By the forcible stretching of the muscles their nerves are likewise stretched; molecular changes being thus set up in both.

4. Forced extension of the muscles causes pressure on their blood and lymphatic vessels, thus accelerating the circulation.

5. Finally, such muscles as have by rheumatic or neuralgic pains been kept in a state of inactivity, have some of their much needed exercise restored to them. Passive movements thus form in certain diseases, as in neuralgia and rheumatism, the introduction, as it were, for the far more painful active motions which have to follow.

The pain produced by active movement is soonest overcome if the early sensitiveness be diminished by previous passive motions, and the patient will more readily learn to bear the pain which he is obliged to inflict upon himself, if he has once experienced the benefits which followed the pain caused by his physician.

The different varieties of passive motion consist of flexion, extension, supination, pronation, and rotation, according to the nature of the joint involved; the force as well as the rapidity

with which these motions are performed admitting, of course, of every possible gradation. In the beginning it will be necessary to proceed very cautiously and gently, and complete flexion, extension, or rotation should not be performed, so as not to cause too great pain. At first the indications can be but partially fulfilled. When the patient has become somewhat used to the pain, however, more energetic measures can be pursued. On the other hand, if it is a question of time, and if the patient be of strong constitution and will, vigorous passive movements may be used from the start.

FIG. 17.

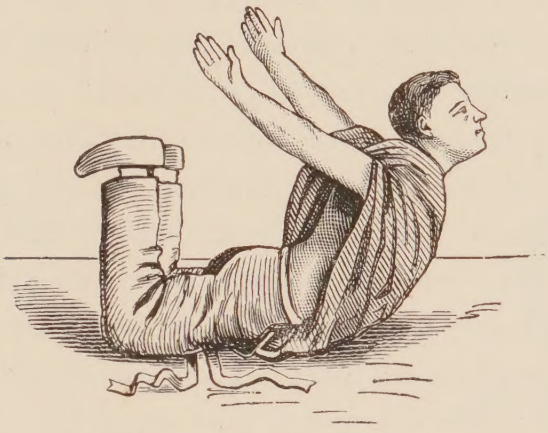
In the oldest work on medical gymnastics (the *Cong-Fou*, translated in the last century by the learned French missionary Père Amiot), figures may be found (Figs. 17, 18, and

FIG. 18.

19) illustrating movements of the extremities, head, and trunk, and intended to represent the treatment of certain diseases.

Fig. 19, for instance, represents the movements used for the cure of lumbago.[1] In Hungary this means has been in use under the name of "Csömör," since time immemorial. Its chief practitioners there are old women.

FIG. 19.



Besides movements of the joints, we may include under passive movement driving, riding (that is, in those cases where the patient does not take an active part), being carried in litters or chairs [as occurs in the Swiss Alps], being swung in a swing, etc.

SHOULD THE PARTS TO BE TREATED BE PREVIOUSLY OILED?

Heretofore, most writers have advised oiling the parts of the body to be manipulated. I have found, however, that for many manipulations inunction not only does not facilitate treatment, but, on the contrary, renders it more difficult; and I have, therefore, for a long time past confined its use to a few procedures only. The nature of the different manipulations employed is the best indication for the proper use of an unguent. Labile manipulations, when extending over a considerable surface, can perhaps best be performed with the skin oiled, for the motion is performed in a direction from the periphery toward the centre, and as the hairs are disposed in an opposite course, the operator's hand glides over them without pulling or tearing, thereby saving the patient painful, or, at least, unpleasant sensations. Stabile interferences, on the

[1] N. Dally: Cinésiologie ou Science du mouvement. Paris, 1857.

other hand, are directly impeded by inunction. The manipulator's fingers glide from the slippery surface, for a part smeared with oil or grease can with difficulty be kneaded, pinched, or hacked.

The supposed softening of the skin by the inunction is of no possible use, for in nearly all cases it is a question of affecting not the skin but the deeper parts lying beneath. If necessary, labile manipulations may be performed with equally good effects without previous inunction—only the sensations of the patient are apt to be less agreeable. A story is told of the celebrated "natural healer" Pich, who lived in Horizka, in Bohemia, and who was originally a "horse doctor," lacking all medical or even veterinary education, and who yet, by his miraculous cures of joint troubles, became a celebrated man, often consulted by the educated and wealthy. A lady, moving in the best circles of Vienna, suffered from an obstinate knee-joint trouble, which prevented her walking. After having consulted in vain the talented Professor Schuh, of Vienna, and Nélaton, then so celebrated in Paris, as well as other noted surgeons of the day, she went, as a last resort, to Pich (which was the means, if I mistake not, of a licentiate in medicine being bestowed upon him later). Pich manipulated the joint, and rubbed it plentifully with his wonderful salve. In a few weeks the lady was cured and able to use her leg as of old. As she was leaving, she begged some of the salve of him. "Ah! the salve by itself would do you no good," answered the sly old fellow, "it has to be rubbed on in a particular way, and not every one can learn how to do that!" This, which was an actual occurrence, took place somewhere between 1850 and 1860. In the twenty-five years that have passed since then mechano-therapy has gained for itself a fixed place in science, and to-day, in a similar case, the professors would not have to allow any "wonder doctor" to bear the palm of victory from them.

IS TREATMENT TO BE UNDETAKEN UPON THE NAKED OR CLOTHED BODY?

Except in sprains, where the part must necessarily be stripped for treatment, mechanical manipulations should be undertaken upon the clothed body. In many cases, indeed, I prefer that it should be clothed, for the pain is often less, and as the skin is not the seat of the trouble, it is more protected; and

FIG. 20.

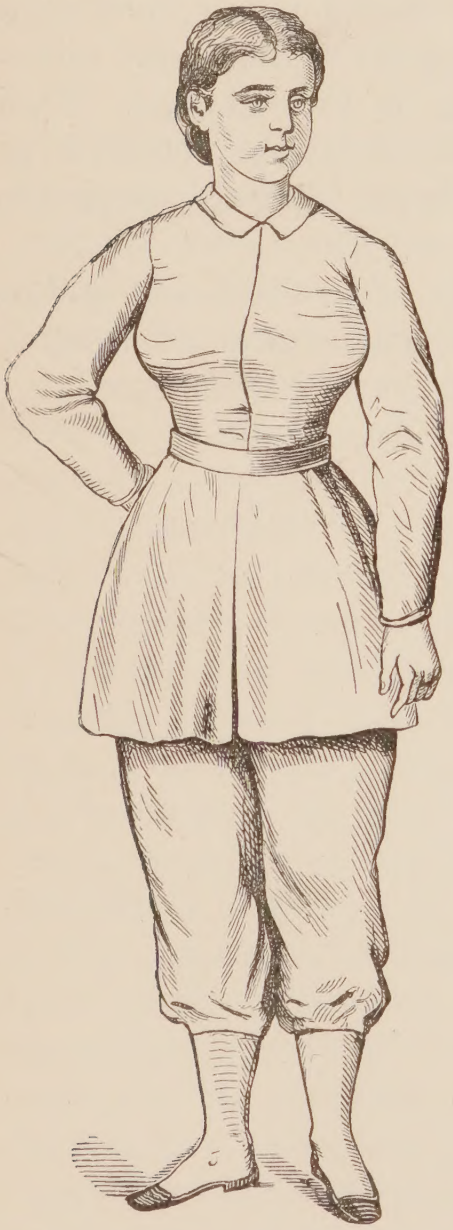


FIG. 21.

then, again, the hand of the operator is often enabled by the clothing to get a better hold. Neither men nor women, however, can be treated in their ordinary dress. Probably the

best costume is an ordinary gymnasium suit of thin flannel, as it readily allows all passive and active motions which form such an indispensable part of the treatment. Linen is not suitable, as the hand slips easily and soon becomes fatigued.

In the case of women, the question of being clothed is of great moment, for in many instances they would refuse treatment altogether had the latter to be performed on the naked body. For them, the dress should consist of loose trowsers coming below the knee and fastening around the calf with an elastic band. A comfortably fitting sleeved blouse, buttoning down the front and reaching to the middle of the thighs, serves as a waist. A belt aids in holding up the trowsers. Thin leather shoes should be worn. Dark colors are preferable, as ladies do not fancy light-colored costumes, being too suggestive of a masquerade. (Fig. 20.)

For men, the best costume consists of trowsers and undershirt of jersey-cloth, fitting not too tightly, with a soft woollen belt and light leather shoes. (Fig. 21.)

CHAPTER IV.

Active movements. Calisthenics and Swedish movement-cure. Apparatus. Physiological effects of gymnastics on the heart and circulation, on the skin and kidneys, on corpulence, on respiration, on digestion, on the central nervous system, and on the mind.

ACTIVE MOVEMENTS.

ACTIVE movements, like the passive ones just described, are of great service in certain joint diseases, such as sprains, contusions, pseudo-ankyloses, chronic rheumatic arthropathies, stiffness, synovitis, etc., also in affections of the muscles and nerves, as neuralgia, paralysis, anæsthesia, muscular rheumatism, writer's cramp, chorea, neurasthenia, etc. In all constitutional troubles, also, where the object of treatment is to simultaneously improve the quality of the blood and the tone of the heart and vessels, and to stimulate peristalsis and the activity of the intestinal glands, as obtains in chlorosis, anæmia, constipation, chronic gastritis, etc.

On the other hand, passive, as well as active movements are entirely useless in the treatment of enlargements of glandular organs, as in mastitis, hypertrophied lymph nodes, or uterine subinvolution. In these cases if active and passive movements are undertaken in conjunction with mechanical interferences, the effects of the two must be carefully separated.

For certain cases active movement forms an indispensable part of the mechanical treatment. In treating deep-seated neuralgias, muscular rheumatism, constipation, or neurasthenia, for instance, the cure might be delayed, if not indefinitely postponed, were not active movement combined with the other mechanical interferences. Even in the beginning active movements are to be recommended, though with circumspection—first using the easiest and simplest forms, and finally progressing to the more difficult.

In sprains and contusions of joints, in chronic rheumatic

arthritis, and other joint troubles, mechanical manipulations play the chief part. Passive motion should be resorted to late in the course of treatment, while it is left to active movements to crown the completed cure.

CALISTHENICS AND SWEDISH MOVEMENT-CURE.

Passive and active movements have been classed together under the terms sanitary gymnastics or calisthenics. Several authors have published bulky volumes on "kinesipathy," "kinesiatrics," "*cinésiologie*," which, notwithstanding their merits, have, through size and prolixity, deterred the busy practitioner from consulting them. In works on the Swedish movement-cure we encounter a most absurdly difficult and complicated nomenclature, often quite sufficient to deter the average physician from ever attempting to engage in this line of practice. And while I intend to give a hasty sketch of the Swedish methods, I may as well state here that it is my firm conviction that the general practitioner will be able to employ this or any other form of mechano-therapy with the best results without a previous knowledge of even one of the jaw-breaking terms applied to many of the procedures used.

Sanitary gymnastics do not necessarily differ from ordinary gymnastics. There is, however, this essential difference between them, that while gymnastic exercises usually aim at influencing the body as a whole,—seeking in this way to prevent organic disease and to strengthen the individual bodily, mentally, and morally—sanitary gymnastics, on the other hand, seek to operate on special parts of the body. By their aid diseased portions are forced to return to their normal state, and impaired function is restored. Naturally enough, in certain cases (as in anæmia, chlorosis, and scrofula) the end and aim of both these forms of exercise must often be the same.

In sanitary gymnastics we seek as far as possible to isolate separate movements by excluding the coöperation of certain muscle groups. To accomplish this, an exact knowledge of existing anatomical and physiological relations is absolutely necessary. For ordinary gymnastics, where general results only are sought to be attained, such knowledge is not requisite.

The Swedish system seeks virtually the same ends sought by ordinary sanitary gymnastics, only in it the isolation of the parts to be treated is effected readily and simply by methods founded on an anatomico-physiological basis, which is the invention of Ling. The essence of this method consists in presenting a resistance to the intended motions of the patient, either by the physician himself or by an assistant.

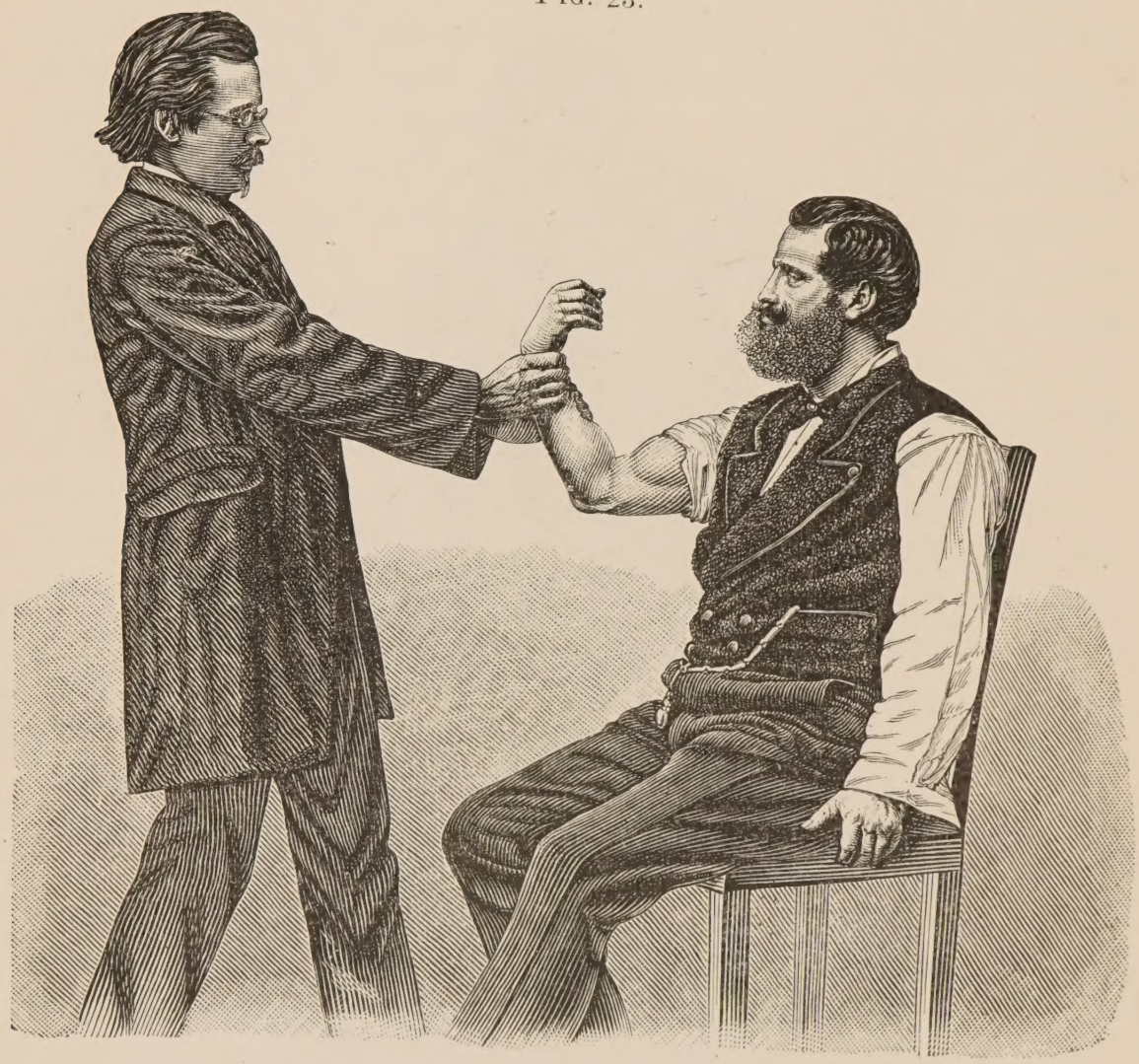
FIG. 22.

Physiology shows that the acid reaction in a muscle is increased when a certain resistance is presented to its contraction, and that this acidity (due probably to the formation of free [sarco] lactic acid) is characteristic of the working muscle.

Ling knew as little of this physiological fact as Priessnitz did of the physiological action of hydrotherapy, yet both, seemingly by instinct, divined the truth. By Ling's method the action of antagonizing muscles is eliminated by the operator, —as will appear more plainly by an illustration.

Let us suppose a patient to be suffering from paresis of the flexors of the forearm. According to Ling, the flexors must

FIG. 23.



therefore be strengthened by exercise. But exercise of the whole arm is contraindicated, otherwise the antagonizers of the paretic flexors would be strengthened as well. Ling very correctly observed that in such a case the healthy muscles, being more completely under the influence of the will, would be strengthened proportionately more than the paretic ones. A certain resistance, therefore, must be opposed to the unconscious contraction of the flexors (Fig. 22) and this can be

effected by substituting the force of the operator for that of the muscles. By this, the latter being put in a condition of complete inactivity, the flexors alone are compelled to work.

Isolation of the function of a single muscle group may be accomplished in two ways:

1. The operator opposing his power to that of the contracting muscles, as in Fig. 22, the limb being extended. Ling called this the "concentric duplex movement." Duplex, because two individuals engage in it; concentric, because the patient's muscles have to overcome a resistance which prevents flexion —*i. e.*, a movement toward the trunk.

2. The patient semi-flexes his forearm, thus contracting the affected flexors, whilst the operator seeks to extend it forcibly. (Fig. 23.)

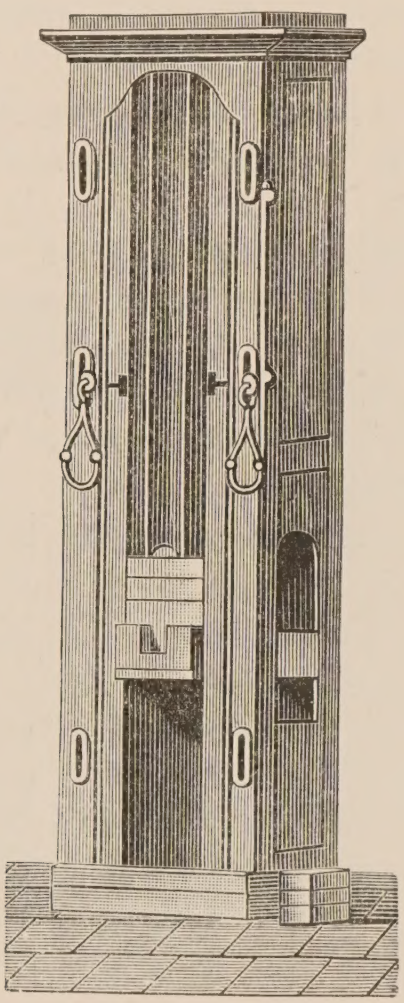
Ling called this the "excentric duplex movement" because the force acted in a direction away from the body. Experience will teach the physician, or his trained assistant, to regulate the force necessary to be employed. In the correct estimation of the precise amount required the superior skill of the operator will be most clearly shown. There should never be anything approaching a struggle between patient and operator.

THE USE OF APPARATUS.

The opinions of mechano-therapists are widely divergent upon this question. I have already expressed myself, in accordance with my own experience on the subject, by saying (page 39) that a skilful operator can, with his hands, perform everything for which another will need apparatus. Still, I do not mean to assert that apparatus may not at times be successfully employed; indeed, the resistance movements, which play the chief part in the Swedish system, can be more accurately regulated, and good results more rapidly attained by means of suitable apparatus than by the operator alone. Even if we admit that the operator may have his own muscles so under control as to be able to change at any moment the force he employs, still, can he also measure so exactly the force of the disabled muscles which he is called upon to resist? The power of the operator and that of the affected muscles are

like the pans of a balance, of which one represents the thing to be weighed, the other the weight itself, and to accurately measure the former, many trials are often necessary. The amount of resistance to be employed by the operator resolves itself, therefore, into a simple mathematical problem, which can be more readily and accurately solved by an inanimate apparatus, than by a variable force constantly under the influence of the will.

Fig. 24.

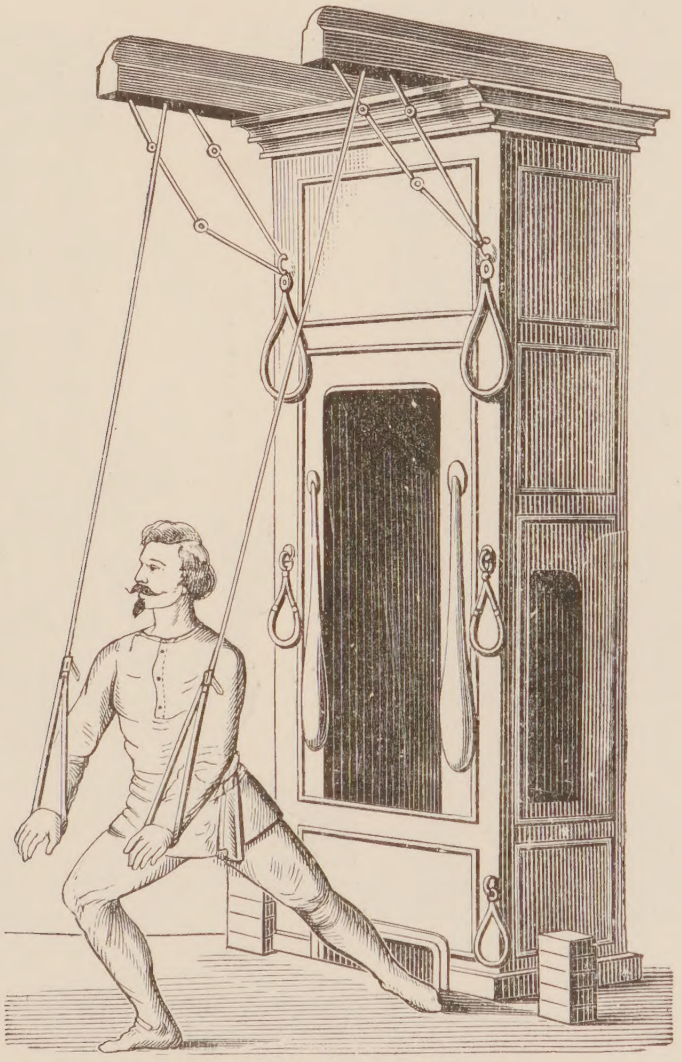


The strength used by the operator should be increased proportionately as the affected muscles become stronger. The weight which the patient was yesterday able to lift or push gives us a mathematical basis for increasing the weight to be used to-day. The muscular power used by the operator could give us no such indications. An apparatus allows, also, the progress of the cure to be exactly measured at any time.

I cannot, therefore, agree with Rossbach's view, according to which the human hand cannot be substituted by apparatus. On the contrary, I consider apparatus far more useful than the necessarily varying resistance afforded by the operator himself.

The construction of the apparatus used is very simple.[1] (Fig. 24.) For the movements of lifting or pushing, a rectangular cage, capable of being loaded with any desired weight,

FIG. 25.



is suspended in a suitable casing, by ropes passing over pulleys, and furnished with wooden handles. The handles may be either grasped by the patient's hands, or used like stirrups

[1] It is scarcely necessary to add that far more handy and convenient forms of this apparatus than figured by our author, are manufactured by dealers in athletic goods in this country.—TRANS.

by the feet. (Figs. 25 and 26.) It is very important to have the apparatus securely fastened to the wall so that it cannot be upset by any use, however violent. Each apparatus should have several weight-cages, and the ropes should be arranged to emerge from the casing at different heights from the floor so as to allow of the greatest range of use.

FIG. 26.

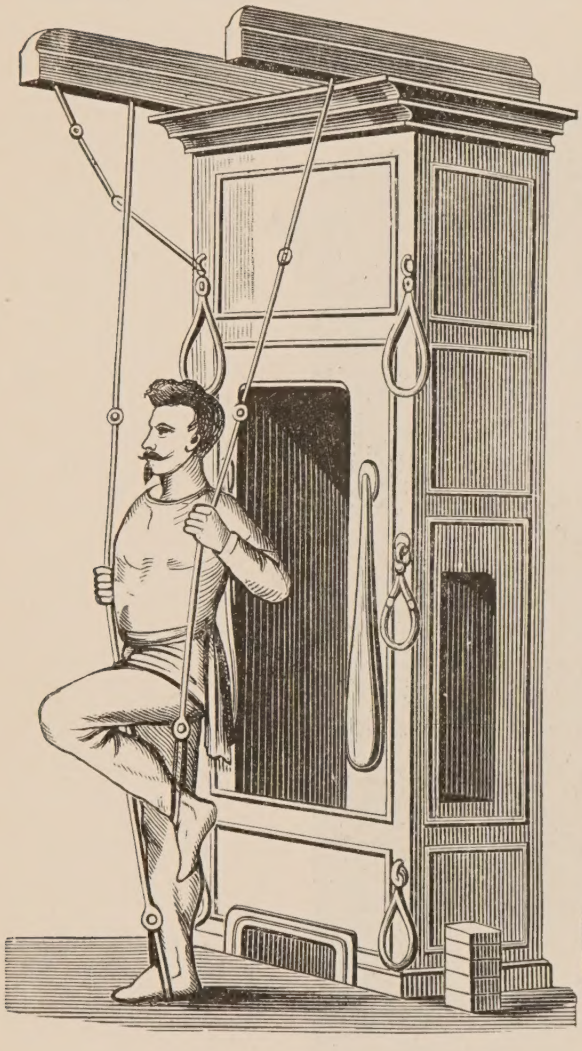
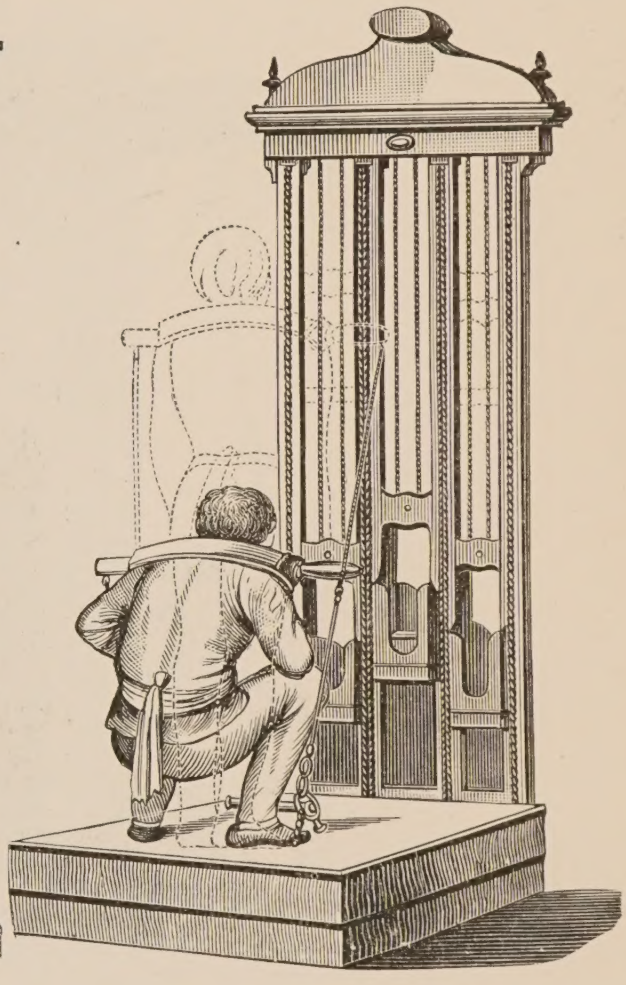


FIG. 27.



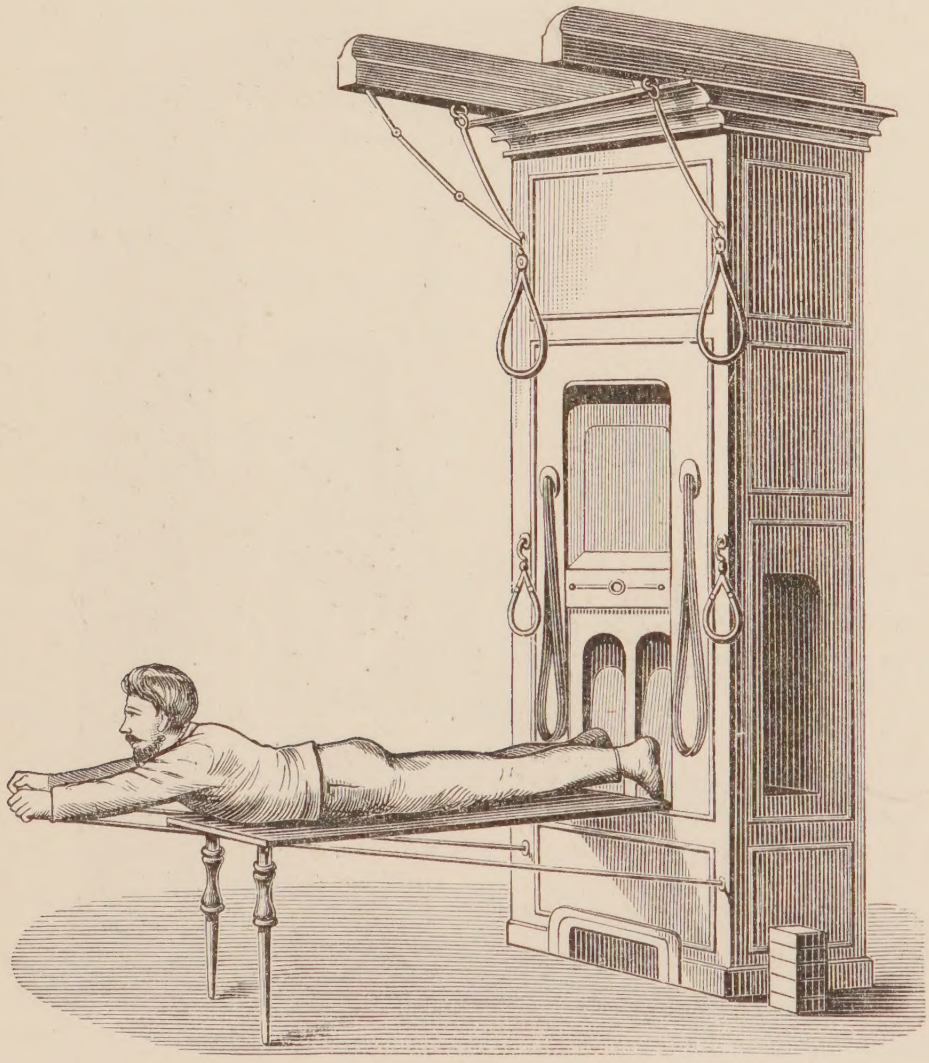
The cages run on tracks, and openings are left in the casing for loading them. As the ropes may be regarded as so many levers upon which the muscles act as loads, it follows that the weight in the cage remaining the same, the force to raise it will needs be greater the nearer the floor the handles are placed—*i. e.*, the shorter the arms of the lever are. When the muscles of the neck and trunk are to be exercised, the ropes

are fastened to a yoke which the patient lifts by his shoulders. (Fig. 27.)

In all these forms of apparatus the particular muscles to be exercised are aided by the coöperation of the whole body, but for isolation of special muscle groups the following arrangements shown in Figs. 28 and 29 have been devised.

When a person lies prone upon his belly it is clear that in moving the rope handles outward no other muscles except

Fig. 28.



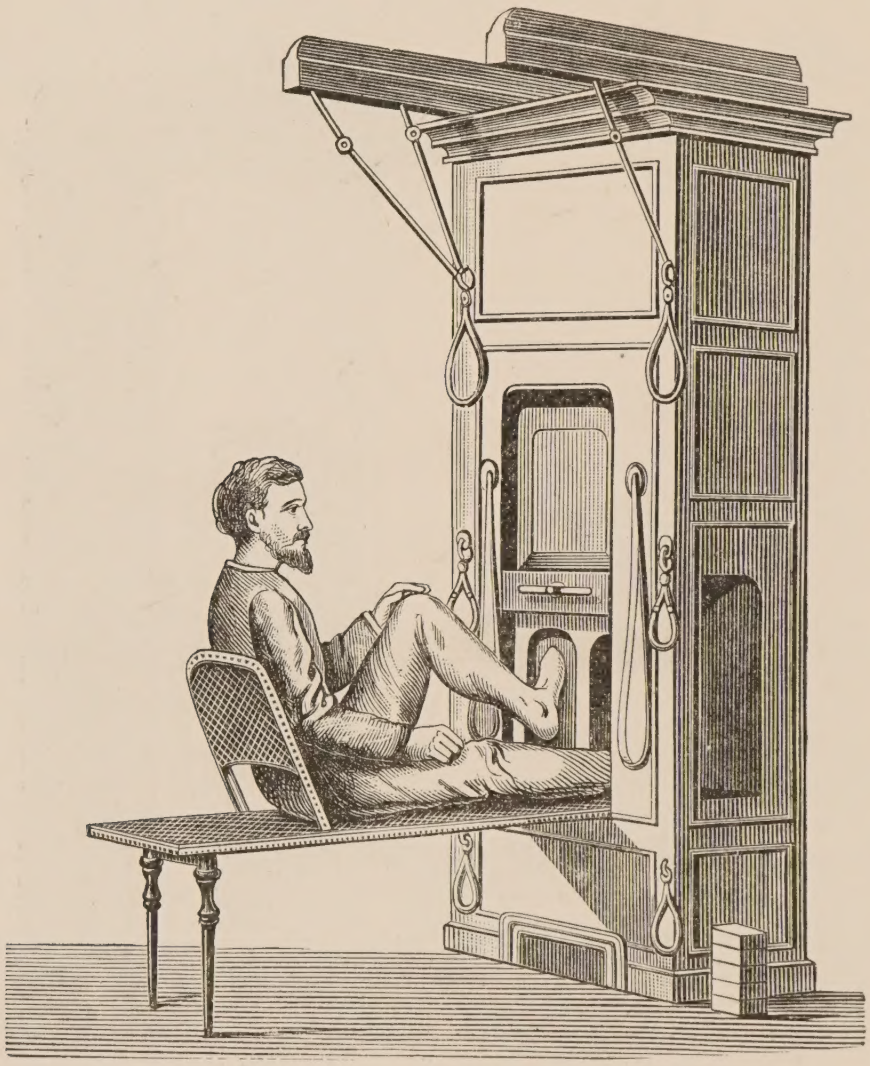
those of the shoulders and arms are called into action. On the same principle, the leg and thigh muscles only are used when the patient attempts, in a sitting posture, to push the weighted foot-boards with his feet—as shown in Fig. 29.

It is always best to increase the work of the affected muscles quite gradually, so as to prevent their becoming too soon

fatigued. A few minutes of rest, also, should be taken between each exercise.

The general principles governing the application of muscular exercise, as laid down above, were first systematized by Ling, and their correctness has been confirmed by every one who has since busied himself with the subject. They are so clear and simple that it is to be regretted that Ling adopted

FIG. 29.



for their description so complicated a nomenclature that it has tended rather to confuse the subject than to elucidate it, and although the specialist may not be deterred in consequence, yet it has certainly put great obstacles in the way of the methods being generally adopted.

Ling recognized five chief primary positions for all movements. These were *standing*, *sitting*, *lying*, *kneeling*, *and hanging*.

These primary positions were subsequently modified and recombined, so that so-called "binary," "ternary," and "quarternary" positions were formed. Thus the position of simple *standing* underwent a fourfold modification, as follows:

First. By the position of the feet, into *standing close*, *standing apart*, *toe-standing*, *gait-standing*.

Second. By position of the arms, into . . . . . .

[The translator is here obliged to pause, for as the Anglo-Saxon mind is happily unable to conceive the absurdities of Ling's nomenclature, the English language is naturally not adapted for the expression of its terms—that is, in single words. In German, as is well known, it is justifiable to coin almost as many new words as the necessity of the user calls for; hence there appears—to a German, at least—no difficulty in rendering Ling's terms. Provided these terms were at all intelligible—which they are not—it would require several paragraphs at least to render one of them into English. That this statement may not seem exaggerated, I will instance as an example the German term for what is called the quarternary combination of the standing position. It contains forty-five letters and nine separate words, though it is written in German as a single word. This literary curiosity I give in one line, separating the words by hyphens, however, for the sake of the English reader, and on the line below the translation of each word will be found.

Links-ruh-rechts-streck-gang-links-seits-stütz-stehen.

Left-rest-right-extended-gait-left-side-support-standing.

It would seem as though only a professional "man-snake" could assume the positions which such a verbal contortion implies. At any rate, the reader is at liberty to try it himself, and should he escape without accident, an account of his efforts will certainly be appreciated by the public in general, and by the translator in particular.]

The opinion of a scientist like Du Bois-Reymond, on the Swedish system, is worth recording. He says: "There can really be no serious questioning regarding the scientific foundation of Ling's system. A mere glance at his writings is enough to show that they are a product of that miserable

'natural philosophy' which for a quarter of a century made a laughing-stock of German science. His arbitrary constructions, his empty-sounding symbolism, his meaningless schematizations, and pedantic terminology no doubt impose on such semi-educated minds which, unable to detect the nonsense, accept a few scraps of anatomy and physiology as evidences of profound learning. For him who has any conception at all of scientific aims it will require no little resolution to wade through writings in which one might reasonably expect to find at least a few valuable facts deposited by this well-meaning though misled individual, whose whole life was devoted to but this one pursuit. But here, too, we are doomed to disappointment. What there is in the book is laid down in a trivial, dogmatic way, and might, the principles being given, have been deduced by any one. Nothing whatever in Ling's writings indicates a truly physiologically conceived explanation of the underlying facts."

"The comprehensive work of Rothstein, a pupil of Ling, may be compared to a great flowing, full-bottomed wig, of a thousand ambrosial curls, placed upon a puppet's empty head. The puppet's head is the limited, hollow, lifeless system of Ling. This forms the nucleus of the book, while the wig upon it is formed of a vast material most diligently collected from every quarter. It often conceals the simplicity of the system, it is true, but at the same time it makes it seem more worthy and attractive. Elaboration is so piled upon elaboration that the real subject under discussion is often, for a long time, lost to view."

"The philosophic, ethic, æsthetic, political, pedagogic, philological, theological, and historical lucubrations need not concern us. Of those anatomico-physiological excursions to which the author treats the reader, I am sorry to say, that they are utterly valueless. His anatomy is made up of extracts taken from the little handbook of Wilson and Hollstein, while in physiology he jumbles together antiquated views with modern facts in a way to display that total lack of scientific judgment not seldom seen in laymen, who think that to achieve a certain end they can, self-taught, master the most complex subjects. A state of confusion has been thus introduced which surpasses all belief,

and which renders any serious criticism of the work as difficult as it would be easy, by the quotation of a few of his own sentences, to hold the author up to ridicule."

Perhaps Du Bois-Reymond is a little extreme in his views, but it is not my province to investigate here how far the stringent sentence of the great physiologist is justified. Certainly the pompous claims made for mechano-therapy—or, as it is often termed, Swedish gymnastics—to be a universal remedy deserve the severest castigation. Some physicians have asserted to have cured cardiac hypertrophy and atrophy, valvular insufficiency and stenosis, etc., with it, and Neumann even went so far as to say that the effects of gymnastics extended to the ciliated epithelium!

The part chance plays in the cure of chronic illness should never be forgotten. What impotent conclusions are not constantly being drawn from ascribing a cure to some opportunely given remedy? Still, in rejecting part, all need not be thrown away; and Ling deserves undying praise, if for nothing else than that he turned the attention of inquiring and educated physicians once more to a long-forgotten but potent therapeutic means. It is a mistake, however, to try to force physiological explanations for all the means used or the cures that follow. For the present we must rest content in simply searching for the proper explanation and in unravelling the yet remaining obscurities of the subject, rejoicing in the meanwhile in the brilliant successes obtained. Does our ignorance of the physiological action of quinine in causing the splenic enlargement of intermittent fever to disappear, deter us from using this well-tried febrifuge?

Thirty years ago, Romberg, though himself using and recommending Swedish gymnastics, nevertheless had already sharply criticised the extreme direction taken in it by Dr. Neumann in Berlin. Ling's system but shared the fate of all new doctrines, which are either persistently denounced, or by enthusiasts lauded to the skies as panaceas for all ills.

Eulenberg, in whose work[1] the golden mean between these two extremes is happily observed, makes the remark that

[1] M. Eulenberg: Die Schwedische Heilgymnastik. Berlin, 1853.

Ling's method is the only truly rational therapeutic means for the cure of chronic disturbances of motility, such as result from spinal curvature, for pseudo-ankylosis, the phthisical tendency, pigeon-breast, peripheral paralysis, etc. Even in cases of paralysis from lesions of the cord, it may still effect a cure, where all other measures, undertaken after the original disease has run its course, will be found useless. Ling's gymnastics have an even greater and more certain effect upon innervation and nutrition than the common form of gymnastic exercises. Spinal [lateral] curvatures resulting from faulty carriage (in consequence of a preponderance of muscular force of one side of the body) are nowadays never treated by any good orthopædist by any other means than the Swedish system. Still, equally good results are obtained by purely active (German) therapeutic gymnastics, when intelligently applied, as when active and passive movements are combined. One great advantage which the use of the German form has, arises from the simple and easily understood terms employed. How indicative of the movements to be performed are, for instance, such terms as finger-flexion, arm-rotation, leg-lifting, knee-extension, body-circling, shoulder-hitting, elbows back, hewing, mowing, etc.

In 1835, Stromeyer declared that of all means employed in orthopædy against spinal curvature, gymnastics was the most effective and rapid. He did not think a differentiation of the means employed, according to the varying pathological conditions causing curvature, possible at that period; but he recognized, nevertheless, the merit of the Hanoverian royal physician, Leutin, who first recommended suspension by the hands for this affection. The treatment of scolioses by the Ling system, which has scored some of its greatest successes in this very department, requires, however, quite a special study, and can hardly be carried out without both apparatus and trained assistants.

PHYSIOLOGICAL EFFECTS OF GYMNASTICS.

The powerful influence exerted by bodily exercise upon the health, and its secondary effects upon the activity of the brain

and nervous system generally, was well known in ancient times, as the Roman proverb, *Mens sana in corpore sano*, attests.

I. Effects upon the Circulation and Heart.

In the *Cong-Fou* of the Chinese, previously alluded to in the Introduction, it is stated that the circulation in the human body meets with two great obstacles, namely, gravity and friction, and that all manipulations and bodily exercises tending to diminish these, promote circulation. The influence, also, of the respiratory movements upon the circulation and heart's action was also familiar, as we gather from the Cong-Fou, to the Chinese, and from them probably the knowledge was transferred to the Greeks and Romans.

Dally[1] claims that Ling himself obtained the idea of his respiration exercises from the Cong-Fou, or rather from Père Amniot.

In the works of Orisabius (360 after Christ) we find a defence of the theory that active respiration helps to eliminate the effete materials (especially CO_2) of the body, and to stimulate the digestive and other functions. All physicians recognize that systematic exercise is one of the best means of preserving and restoring the proper balance in the distribution of blood in the body. By exercise, local hyperæmias, whose persistence may lead to the greatest variety of derangements, can be made to disappear. The cerebral hyperæmias of brain-workers, the abdominal hyperæmia developed in sedentary pursuits, and the hyperæmia of the sexual organs occurring in individuals given to venereal excesses, are amenable to no treatment so quickly and thoroughly as to active muscular exercise.

In a recent work,[2] Sommerbrot has shown that in all exercises increasing intrabronchial pressure, as singing, laughing, rowing, swimming, running, etc., two sets of effects are produced on the circulatory apparatus. These are: 1. Diminished tension of arterial walls. 2. Increased heart's action. As soon as exercise ceases, arterial tension rises again, while the

[1] N. Dally: Cinésiologie. Paris, 1857.

[2] Sommerbrot: Ueber eine bisher nicht gekannte wichtige Einrichtung des menschlichen Organismus. Tübingen, 1884.

heart's action becomes slow. Sommerbrot looks upon these phenomena as resulting reflexly from irritation of the sensory pulmonary nerves. Intrabronchial pressure becomes, therefore, a regulator of the rapidity of the blood current. All muscular activity, however, increases intrabronchial pressure by decreasing the amount of oxygen and increasing the quantity of carbonic acid in the blood, thereby stimulating the respiratory centre and causing respiration to be more rapid and deeper. The effects of muscular activity are, therefore, increased use of blood, and consequent consumption of oxygen (for the body when active consumes four to five times as much oxygen as during quiescence), increased renal activity, and, lastly, regulation of temperature.

We have seen (Chapter II.) that the vessels of a muscle in a state of activity are dilated, and that there is a resulting increased supply of blood. Hence it follows that these dilated vessels serve as so many reservoirs into which the congested internal organs can pour their surplus blood. The effects of bodily exercise upon relieving the portal circulation, arise first from the augmented rapidity of the blood current resulting from increased peristalsis, and, secondly, from the operation of a direct mechanical force, namely, the contraction of the abdominal muscles; which, by diminishing the cavity of the abdomen forces the blood toward the heart.

Increased oxygen consumption by the active muscle means increased elimination of tissue waste, and a proportionate increase in nourishment and strength. From the nervous supply being also better nourished, there arises that pleasant sensation of energy and bodily vigor which always follows hearty exercise.

Muscular exercise is an excellent prophylactic against that very common disease of old age, arterial sclerosis, and its attendant cardiac hypertrophy.

In corpulent persons, the deposits of fat in the abdominal cavity cause, at first, compression of the larger intestinal veins, and, finally, of the smaller arteries as well. Large accumulations of gas are also apt to occur in these individuals from feeble peristalsis and the retention of feces in the alimentary canal. The vessels of the intestinal walls consequently become

compressed between the gas from within and the fat from without, and the blood, thus driven from the abdomen, surcharges the circulation of the rest of the body. One inevitable result of this overfilling is venous dilatation, just as in pregnant women pressure of the gravid uterus against the great venous trunks in the pelvis causes varicosities of the veins of the lower extremities. As the overfilling increases, the circulatory disturbance is propagated from the veins to the capillaries, and, finally, to the great arterial trunks themselves. The last link in the chain—one that develops gradually during the course of years—is increased aortic blood-pressure and all the consequences which follow in its train (cardiac hypertrophy and arterial sclerosis).

No method for preventing or relieving portal congestion can surpass in efficiency the employment of systematic exercise of the abdominal muscles.

II. Effect on the Skin and Kidneys.

It has been determined by Voit and Pettenkofer, that both the velocity of the circulation and the arterial pressure are increased by muscular exercise, and that there results, in consequence, a correspondingly increased elimination of water by both skin and kidneys. The perspiration following exercise is a patent instance of this. During a state of muscular inactivity, therefore, skin and kidneys both act less energetically, and a certain retention of water[1] must occur, giving rise to a variety of disturbances.

III. Effects on the Deposition of Fat.

Prolonged bodily inactivity causes an accumulation of fat to occur in the body as the direct result of lowered oxidative processes. The fatter the body is, however, the less the respiratory vigor, the quantity of blood becoming correspondingly diminished.[2] Active exercise is well recognized,

[1] This is an error. Cohnheim and Lichtheim have shown that the total mass of blood in the body is always approximately the same, and that it cannot be either permanently increased or diminished. An actual hydræmic plethora, therefore, never occurs, though a *relative* increase in the amount of water in the blood frequently results in anæmia from any cause.—Trans.

[2] This statement regarding a diminution in quantity of the blood is equally erroneous. See preceding note.—Trans.

not only as a prophylactic, but also as a curative means against excessive deposits of fat, and in fattening animals this physiological fact has been observed since time immemorial, long before its scientific reason was recognized. Thus, geese intended for fattening are kept in narrow coops where movement is made impossible. A working ox, on the other hand, never gets fat. Cab horses, which are on the go night and day, have good, strong muscles, though their bones often seem to be coming through the skin. Give them but a few weeks' rest and their bodies tend to fill out, even though they may be receiving, at the time, less fodder than before.

As we have already seen in discussing the physiological effects of mechanical interferences, increased muscular activity goes hand in hand with increased heat production, and this in turn with changes in the molecular condition of the primitive elements of the organs (muscle and nerve-fibres) involved, the result being greatly augmented metabolism. Rossbach[1] calls attention to the fact that after the severest muscular work the amount of albumin—that which forms the most abundant and important element of the body—is not affected, and that the elimination of nitrogen is not increased; consequently, that the real source of maintenance of power is not diminished.

IV. Influence on Respiration.

Bodily exercise increases both the action of the heart and the activity of the oxidative processes. For the latter an increased supply of air is a necessity which forces the individual to more energetic breathing. The deeper and more powerful respirations which ensue expand the lungs, thus strengthening by exercise the elastic tissue of the alveoli. (According to Du Bois-Reymond, every tissue of the body, even horny tissue, is capable of being exercised.)

V. Influence on Digestion.

All exercises which call the abdominal muscles into play, by compressing the abdominal contents, stimulate both the portal circulation and peristalsis. The chyle, in consequence,

[1] Rossbach: Lehrbuch der physikalischen Heilmethoden, II. Heft. Berlin, 1882.

is more rapidly absorbed and carried away by the abdominal lymphatics to the thoracic duct. Thus the digestive powers are increased and at the same time the desire for food grows more frequent and marked, and the augmentation of the food supply which follows, and the more thorough elaboration and assimilation which occur, all combine to produce an improvement in the general quality of the blood. Hence the surprising effects of gymnastics in all those chronic maladies which arise from impaired digestion, such as scrofula, chlorosis, and anæmia.

VI. Influence on the Central Nervous System and on the Mind.

Nearly all chronic diseases in which impoverishment of the blood exists, or which are caused by circulatory disturbances, exert generally a markedly bad effect upon the central nervous system. Individuals so afflicted become hypochondriacal, lose interest in things about them, and are frequently subject to irritability of temper. These mental symptoms are, in great part, but exponents of an ill-nourished brain.

Muscular exertion, by increasing blood pressure, and causing abdominal congestion to disappear, puts new life and energy into the organism, while the simultaneous exercise of the necessary will power for the execution of these exercises awakens a fresh interest in life. In individuals who, by reason of mental over-exertion, are the victims of exhausting sleeplessness, depression, and indifference to life generally, gymnastics are of incalculable value for procuring a normal, healthy, and refreshing sleep. Indeed, it may be regarded as often the only saving means in cases where this condition has produced a state almost akin to insanity, and where all other remedies have failed.

Henneberg has proved that during sleep a greater accumulation of oxygen occurs in blood and muscle in a muscular individual than in a weakly or corpulent one, and that the former in consequence feels fresher and stronger on waking than the latter. Upon those mental disturbances, which arise

not from chronic maladies, but from physical causes, bodily exercise has a similarly beneficial effect.

Du Bois-Reymond has presented us with some very interesting and entirely new ideas upon muscular exercise. He shows[1] that muscular exercises are really not so much exercises of the muscular as they are of the central nervous system, especially of the brain and cord. The train of thought of this great thinker is such a fascinating one that I cannot forbear the temptation of quoting it here at length. He says: "By exercise we usually understand the frequent repetition, seconded by the aid of the mind, of some more or less complex action of the body, for the purpose of attaining perfection in that exercise, or, it may be, the exercise of the mind alone. In physiological text-books we generally seek in vain for information upon exercise, and if any is vouchsafed at all, it is with regard to bodily exercises; and these are considered solely as exercises of the muscular system. Now, it is of course true that for such exercises as gymnastics, fencing, swimming, riding, dancing, skating, etc., a certain degree of muscular force is requisite, but we may very well imagine an individual with muscles like the Farnese Hercules, and yet unable either to stand or walk, let alone to execute complex movements. This we see when we deprive him of the power of regulating and coördinating his movements, by giving him chloroform or making him drunk. It is plain, therefore, that every motion of our body depends, not so much upon the force of the contractions of the muscles, as upon the harmony of their action. To execute any complex act, as a leap, for instance, each muscle must begin to contract at exactly the right moment, and the force exerted by each must, according to definite laws, increase, continue, and diminish again, in order to effect the suitable position of the limbs, and to propel at the proper speed the centre of gravity of the body in the desired direction.

"We have as yet but little knowledge of the mechanism by which we measure off to muscular energy the period of its continuance, our researches so far having only enlightened us

[1] Emil Du Bois-Reymond: On Exercise. An Address delivered at the celebration of the founding of the military medical institutions, August 2, 1881. Berlin, 1881.

regarding contractions resulting from stimuli of infinitesimally short duration, and on tetanus. We have reason to believe—in spite of its not occurring in these two extreme cases—that, as a rule, the muscle promptly obeys the nerve, and that its degree of contractility for each moment is determined by the degree of irritability of the nerve which obtained at the moment just preceding. Since the nerves are merely organs for the conduction of impulses originating in the motor cells, it follows that the actual mechanism of every complex motion must have its seat in the central nervous system; and consequently that practising exercises is nothing more than the schooling of the central nervous system. The latter has the wonderful faculty of causing series of motions, which it has previously frequently imitated, to recur in all their varied modulations as soon as the proper volitional impulse (which, however complicated, is effected only as a unit) goes forth for their accomplishment. All species of bodily exercises, therefore, are not simply muscular gymnastics, but nerve gymnastics too."

This twofold nature of bodily exercise had already been recognized by Johannes Müller, but he did not emphasize the fact enough. He made an observation, however, which strikingly confirms the truth of Du Bois-Reymond's statements, namely, that perfection in bodily exercise consists often as much in the suppression of useless movements as in the acquirement of those desired. The gymnastic treatment of chorea depends, indeed, chiefly on the recognition and utilization of this physiological fact.

It is only necessary to watch, says Du Bois-Reymond, a boy for the first time climbing a ladder by means of his hands; how, although it is only a hindrance, he throws his legs about with each movement of his arms. In a few weeks, however, the hip-, knee-, and ankle-joints will be kept well extended, the legs close together.

Of the mechanism of inhibition of correlated movements we know nothing; but it is evident that where by practice the suppression of certain muscular actions has been attained, it would not be justifiable to regard the outcome of this practice as having resulted in the simple strengthening of these particular muscles, though we are inclined, at first sight, to look

upon every exercise as having in view a positive increase of muscular power.

Something besides mere muscular control must come into play during the execution of complex movements. The eye, pressure, and the muscular senses, and, indeed, the intellect itself must all be constantly on the alert to perceive instantly each changing position of the body, in order that the key, conveying the impulses to each muscle, may be struck at exactly the proper moment. It is not the motor nervous apparatus alone, therefore, that is capable of cultivation by muscular exercise, but the sensory and the mental functions as well,—the importance of the muscles, merely as such, becoming relegated to a less lofty place in the system of gymnastics. What has been stated here of the coarser kinds of movements, is equally true of every species of dexterity. A Liszt or a Rubenstein is hardly conceivable without an arm, whose muscles are like iron, and in the use of Joachim's violin bow during the performance of a symphony many kilogrammetres of force must be expended; nevertheless the skill of these artists lies not so much in their muscular as in their central nervous system. The dexterity of a turner, of a machinist, or of a watchmaker, skill in writing, drawing, or needlework, and in those humble yet none the less artificially acquired operations of our daily life, as dressing, using a knife and fork, etc., what are they after all but connections between the various ganglion cells, painfully established at first, but which, after having been traversed for a certain number of times, cause the operation to be performed with the greatest ease and harmony, and finally in an entirely automatic manner.

The chemical changes which follow muscular work afford a ready index to the great value of gymnastics. The details of these processes may be found, by those who wish to consult the particulars, in the recent work of Fick[1] on the subject. We content ourselves in giving only his conclusions.

He is of opinion that muscular contraction, which of all vital phenomena appears at first sight the most inexplicable and

[1] Fick: Mechanische Arbiet und Wärmeentwicklung bei der Muskelthätigkeit. Leipzig, 1882.

enigmatical, is in reality capable of a mechanical interpretation. The fundamental phenomenon of organic life consists of a change in form of the protoplasmic elements—the result of stimulation. This change of form (movement) is microscopically demonstrable. In the muscle fibre, however, where the protoplasmic molecules are arranged in innumerable parallel rows, this change of form eludes even the microscope.

Fick calls muscle substance "crystallized protoplasm," and thinks it not improbable that some day it will be possible to artificially imitate muscular contraction.

From such simple observations as may easily be made upon ourselves it is evident that certain chemical changes occur in muscle as the result of work. Every one knows that after a group of muscles has been forcibly exercised for some time the response to the will is no longer so prompt as before. This phenomenon, known as fatigue, proves conclusively that some intrinsic change must have occurred in the muscle itself as a result of the work performed, for had the muscle remained atomically unaltered there is no reason why it should no longer react to each fresh impulse of will, or nervous stimulus, sent to it. So long, however, as the muscle preserves its connection with the body intact, this condition of fatigue will disappear again, by metabolic changes being brought about by the circulating blood. There are, indeed, muscles in which the compensation for destructive changes resulting from work exactly coincides with their functional activity, so that it is possible for them to continue in action for a lifetime without experiencing either interruption or fatigue, as in the case of the heart. It is evident, therefore, that the signs of fatigue will soonest show themselves in muscles which are deprived of their blood supply from being isolated from the rest of the body.

There is another well-known sign which points to the nature of these chemical changes, namely, the increased demand for air, indicated by shortness of breath. On going up a flight of stairs, we notice that the number and depth of the respiratory acts are involuntarily increased, and we know that by increased respiration the introduction of oxygen and the elimination of carbon dioxide are correspondingly augmented.

But we know, also, from general experience that the degree of intensity of the respiratory act is automatically adapted to the wants of the organism; for were not all the organic functions thus arranged, death would soon ensue. We are consequently justified in concluding that this increased respiration at times of great muscular energy is an evidence that more oxygen is consumed in the body during periods of activity than during repose, or, in other words, that concomitant with muscular energy increased combustion of the carbon compounds of the body takes place. Wherever combustion occurs—that is, wherever chemical action is going on—a part of the effect always consists in the creation of irregular molecular vibrations, which manifest themselves as heat.

It is a constant experience that increased production of heat accompanies muscular exertion. The temperature of the whole body rises during muscular activity, and especially is this true of the skin, on account of the increased blood supply which occurs in it. Unless the surrounding atmosphere is too cold, the skin soon becomes bathed in perspiration, which by its evaporation keeps the body temperature always at the normal point. Thermo-electric experimentation, also, has afforded direct proof that muscular tetany is accompanied by the evolution of heat. The experiments of Helmholtz and Heidenhain on this subject will be found in the work of Fick, just cited.

The comparison made by some physiologists between a muscle and a steam engine is quite apt. As in the fire-place of the engine, so too in the muscle, combustion of carbon and hydrogen compounds takes place. In the steam engine, chemical energy is utilized for the exploitation of the latent heat contained in the combustible gases of the coal; this heat being transferred to the water in the boiler, where part of it, by means of a suitable mechanism, is converted into other forms of energy, while another portion either escapes into the air or is conducted into the cold water of the condensor.

It would not perhaps be unreasonable to assume that analogous processes occur in the muscles. Each fibre may be supposed to contain a substance ready to undergo combustion under the influence of a nerve impulse; that the heat so produced is in part used for the production of work by a

microscopically small machine, and in part carried away by the circulation as such. The muscle, consequently, is to be regarded as a thermo-dynamic machine. Experiments made for the solution of this supposition show, however, that the normal muscular contraction is not a thermo-dynamic process, in which the heat produced by combustion is primary, and the conversion into mechanical energy secondary. On the contrary, the needful chemical affinities are, from the very start, arranged for, and bear direct relation to, the mechanical end in view. That this process should take place, however, without any irregular molecular vibrations is, *à priori*, very unlikely; and as an actual fact, therefore, we do see that besides the mechanical effects of muscular contraction there is also production of heat.

CHAPTER V.

ON THE DISEASES SUITED TO THE APPLICATION OF MECHANO-THERAPY.

In order to keep the object with which this book is written strictly in view, we will consider here only such maladies whose successful treatment by mechanical means is beyond all doubt, and is generally recognized by the whole medical profession.

It has of late been the fashion to call mechano-therapy—*vulgo*, "massage"—into requisition for the treatment of every conceivable pathological condition; and then, from the observation of a few or even single cases, to ascribe the cure obtained to the treatment used. Nothing can be more hazardous to the success of a new therapeutic measure than to form an opinion regarding either its efficacy or its uselessness from insufficient observation; this is true both for such diseases as would either recover of themselves, no matter what the treatment, as well as for such as resist all forms of cure.

A severely critical interpretation of Gerst's[1] results, for instance, is necessary when we read of his curing by massage acute catarrhs of the nose, pharynx, Eustachian tube, middle ear, larynx, and tonsils; or when he states having observed considerable improvement within a month, in a case of chronic ulcerative laryngitis complicating pulmonary phthisis, which he treated by stroking either side of the neck and larynx,—not omitting, however, at the same time, to use inhalations of a carbolized spray!

An acute tonsillitis disappearing after three days' treatment by massage, even if seven such cases have been observed, can form no basis for the conclusion that the cure was due to the treatment, for such inflammations will generally disappear without any treatment whatever.

[1] Gerst: Ueber den therapeutischen Werth der Massage. Würzburg, 1879.

If Gerst could cite fifty cases of tubercular laryngeal ulcer materially improved by stroking the neck, some conclusions might perhaps be legitimately drawn. Influenced by Gerst's reports, I have, during the past two years, patiently and persistently used stroking in numerous cases of phthisical ulcerations for many weeks, without being able to see the slightest improvement. I have, very rarely, it is true, observed these ulcers to heal spontaneously.

For a new method to be recommended and adopted it must, in the first place, either be a more rapid means of cure than others, or it must prove itself effective where all other measures have failed.

It is necessary that in all our investigations we should be strictly guided by these two considerations.

Mechano-therapy will, in accordance with its physiological effects, be successful where it is desired to produce the following results:

1. To cause an increased flow of blood to muscles and soft parts, increasing thereby the circulation and removing accumulations of tissue waste, whose retention causes various disturbances of function. To strengthen muscle fibres, and by setting up molecular vibrations to induce changes, not only in the muscle and nerve fibres, but perhaps even in the nerve centres themselves.

2. To cause the resorption of exudations, transudations, and infiltrations in such organs as are accessible. To effect the separation of adhesions in tendon sheaths and in joints, without recourse to the knife. To remove, by grinding away, intra-arthritic vegetations. (Direct effect.)

3. To increase, by passive and active exercise of all the muscles, the oxidizing powers of the blood, in this way correcting disturbances in its composition, and stimulating all the vegetative processes.

4. To relieve the congestion of such internal organs as the brain, lungs, intestines, uterus, kidneys, etc., by increasing the flow of blood to the muscles.

5. To stimulate directly the sympathetic nervous system, thus increasing secretion, and reflexly the activity of unstriped muscle fibre, and so relieving various functional derangements.

6. By systematic exercise (health gymnastics), to educate morbidly affected muscles, to convert abnormal into normal actions, and to suppress useless movements.

I have, in accordance with these physiological effects, sought to arrange the diseases amenable to mechano-therapy into six groups. I am, however, well aware that these divisions cannot be sharply separated from one another, and that some diseases placed in one group will combine with their own the physiological effects ranged under other groups. Nor am I unconscious of the incompleteness of this arrangement, but, as it is founded upon a physiological basis easily surveyed, I think it will prove more useful to the beginner than the more usual arrangement (especially common in French works) according to the topography of the body.

GROUP I. MECHANO-THERAPY OF NEURALGIAS AND MUSCULAR RHEUMATISM.

The treatment of these two conditions may be disposed of under one heading, since it is the same for both. The chief symptoms of each are great pain and disturbed function. In both the actual nature of the diseases is not known with any certainty, nor does their pathological anatomy seemingly afford any clew; medical writers, consequently, are forced to rely upon hypotheses and surmises. Regarding the changes in the sensory nerves in neuralgia and myalgia we know nothing. So great is the obscurity involving the nature of neuralgia that Erb[1] regards as premature all definitely formulated explanations of the subject, and Senator,[2] in the introduction to his work on the locomotor apparatus, says: "'Muscular rheumatism' is a heading under which are, at present, ranged all troubles, both in the muscles themselves and their neighborhood, and which cannot be elsewhere placed. Of it, it may be said, to paraphrase the old rule in the grammar, pains which cannot be defined may be regarded as rheumatism."

J. Mortimer Granville[3] regards abnormal vibrations in the

[1] Erb: Handbuch der Krankheiten des Nervensystems, II. Leipzig, 1876. [Ziemssen's Cyclopædia, Am. Ed.]

[2] Senator: Handbuch der Krankheiten des Bewegungs-Apparates. Leipzig, 1879. [Ziemssen's Cyclopædia, Am. Ed.]

[3] Granville: Percussion as a cure for nervous derangements, Brit. Med. Journal, 1882, No. II.

nerve fibres as the cause of neuralgia. Mechanical vibration of the nerves is considered by him to remove pain by converting the abnormal into normal vibrations. To this end he employs an instrument, a percussor, with which a certain number of blows a minute may be given.

It is not always easy to make a sharp distinction between the diseases, for the two not infrequently coexist. Indeed, since no pathological changes have as yet been discovered in the muscles in muscular rheumatism, one hypothesis declares this disease to be nothing else than a morbid irritation of the sensory nerve-endings of the affected parts.

The differential diagnosis is generally made on the character and distribution of the pain.

In neuralgia the pain is felt along the course of the supplying nerve and it branches, while in myalgia it is more diffuse, being distributed over a whole muscle or group of muscles. Neuralgia also is marked by typical exacerbations, while the pain of myalgia is usually continuous.

It would seem, from the fact that both diseases are caused by sudden changes of temperature, or by exposure to drafts, and that mechanical treatment is more quick and sure than any other, that the origin of both is to be sought in molecular changes occurring in the muscle and nerve elements.

In certain individuals a neuralgia or myalgia will make its appearance whenever a certain part is exposed to drafts or cold, and will disappear again as soon as the part is warmed, rubbed, or kneaded, or passively or actively exercised—for heat, according to present views, is but a form of molecular motion.

It is such a well-known fact that neuralgia and muscular rheumatism disappear after other than mechanical treatment, and often, indeed, after no treatment whatever, that in claiming brilliant results for mechano-therapy in this field, we are only justified in doing so for long-standing cases that have resisted all other means.

It is of prime importance before attempting the mechanical treatment of either neuralgia or myalgia to eliminate even the possibility of the existence of certain inflammatory processes as neuritis, periostitis, arthritis, spinal caries, coxitis, etc., for

their presence contraindicates this form of treatment. For the ultimately favorable issue of mechanical treatment, the nature of the neuralgia, whether of central or peripheral origin, or whether the result of a painful affection of a nerve trunk, or plexus, or of some muscle or tendon, is, of course, not immaterial.

Still, even in cases where the nature of the affection is obscure (and many diseases of central origin, as tabes, for instance, have neuralgias among their early prodromata) mechano-therapy can, at least, do no harm. Erb says: "Every experienced physician will admit that a diagnosis may remain doubtful for months and years, and often is disclosed only on autopsy." If nerve stretching which, during the past few years, has so frequently been undertaken by prominent surgeons for the cure of tabes, has been followed by brilliant results,[1] mechanical treatment can surely not be prejudicial, nor would the danger of mistaking myalgia for neuralgia, which might occur to the best diagnostician, militate in the least against the employment of mechano-therapy.

According to Senator, many forms of muscular rheumatism are evidently the result, not of an inflammation, but of a disturbed innervation, either of the muscle itself or its aponeuroses. This is evident when muscles are attacked which from being superficial—as the sterno-cleido-mastoid, for instance—can readily be examined. He adds, that the confusion already existing on this subject is only increased by including these forms among those already admitted. Myalgia is often confounded with those ill-defined neuralgias occurring often in deep-lying nerves, where the pain, instead of following the course of the main trunk, radiates over a considerable adjacent area. The physician, therefore (who, after all, sets more store on curing his patient than on making fine differential diagnoses), may confidently proceed to treatment, and with all the more assurance of success the more evident it becomes that the painful disease, regarding whose exact nature he still may be in doubt, is deeply situated in the muscles themselves.

As in neuralgia, so too in myalgia, more or less profound

[1] It is, perhaps, needless to remark that the efficacy of nerve stretching for tabes is, at the present time (1887), to say the least, very much doubted by the majority.—TRANS.

nutritive changes occur, and though we may, at present, be unaware of the nature of these changes, yet their existence is denied by none. No means is so potent in removing this condition, especially in muscles, as movement, and hence nothing can be more injurious in neuralgia, as well as myalgia, as the frequently recommended rest of the part affected. To Benedikt[1] belongs the credit of giving (in 1864) a fresh impetus to the therapeutic value of health gymnastics. In connection with neuralgic affections of muscles and tendons, he calls attention to the well-known fact that, generally as the result of cold or injury, pains may exist for years, seriously impairing the functions of the parts involved, and yet without the presence of any objective signs. In these cases there can scarcely be any doubt that local disturbances of circulation exist in the organs themselves, or in the terminal nerve-supply.

"The routine treatment by antiphlogistics and absolute rest only too often fails. Household remedies have in these cases stolen many a march on science, and, by applying first stimulating poultices, and then employing motion, especially in the chronic stage, have achieved wonderful success. The labors of those who have sought to introduce health gymnastics are soon forgotten, and it is only through the works of Stromeyer and Volkmann that this form of treatment has again been systematized. The chief thing in these cases is to test carefully both methods of cure at the proper time, and then consistently to employ the best."

In neuralgias resulting from anæmia, hysteria, and malaria, mechano-therapy can exert only favorable influences, for the passive and active movements employed increase the oxidizing powers of the blood, and consequently improve the nutrition of the brain and spinal cord, and the organism generally.

In cases where neuralgia is determined by organic changes, such as result, for instance, from bone disease, tumors, inaccessible cicatrices, senile or other degenerative tissue metamorphoses, etc., mechanical treatment will naturally be followed by the same want of success as other therapeutic measures. It is necessary, therefore, for the proof of the absolute useless-

[1] Benedikt: Nervenpathologie und Elektrotherapie. Leipzig, 1874.

ness of the mechanical treatment of these cases, that as correct a diagnosis as possible be previously made.

Mechano-therapy of Sciatic and Crural Neuralgia.

As the greater number of sciaticas which have come under my notice have been combined with crural neuralgia as well, I think it best to consider these two conditions together. It seems advisable, also, to discuss the treatment according to a plan which may, with suitable modifications, be applied to each special case, and yet one which will embrace the details gleaned from numerous observations. Let us take a case. A patient suffering from well-marked sciatic and crural neuralgia of the right side applies for relief, after having been under treatment by others for many years in vain. He has used veratria, aconite, and belladonna ointments, morphine injections, electricity, sinapisms, and vesicants. We may assume, also, that for a considerable period he took arsenic, quinine, and potassium iodide and bromide, that he has been to a number of springs like Gastein, Wiesbaden, Teplitz, and Ragaz, and also that neither sea-bathing nor hydrotherapy has had any effect upon his obstinate malady. He is only able to drag himself painfully along by the use of a cane, and every step causes acute suffering. Rising and sitting down can only be accomplished by aid of the arms, while for going up stairs or getting out of bed the assistance of an attendant is necessary. He is never entirely free from pain, and there is generally a daily exacerbation lasting often several hours and preventing much needed rest.

Examination shows no other functional disturbances. There is great sensitiveness in the buttock, at the point of exit of the sciatic nerve, and many painful points exist along the outer and inner aspects of the thigh. The limb, furthermore, will be seen to be held in a characteristically pathognomonic position, namely, the thigh rotated inward and adducted, the knee slightly bent, and the foot not resting on the ground with the sole, but touching it with the toe only.

On sitting down, the patient supports himself by his left arm, and lets himself fall, as it were, upon his left buttock, instead

of performing the usual movements of flexion with knees and hips. The involvement of the semitendinosus and semimembranosus muscles causes great sensitiveness to pressure over their tendons. Voluntary abduction of the affected thigh is impossible, and abduction of even the well extremity cannot be performed on standing erect, on account of inability of the patient to support himself upon the affected limb. External rotation is also impossible. Hence it appears that the glutei, the pyriformis, the internal obturator, and the gemelli (external rotators), are all affected. Nor can the patient flex the thigh (involvement of the iliac and psoas major), nor can he adduct it after it has once been passively abducted (involvement of the sartorius, internal rectus, adductors longus, brevis and magnus, and pectineus). But the greatest pain of all is caused by rotating the thigh outward, as the sciatic is thus made to glide upon, and rub against the quadratus femoris.

I have purposely selected a case in which all the muscles of the buttock, about the hip-joint, and of the thigh have become involved, and hence almost entirely deprived of function. Many years of experience, and many trials, have convinced me that the cure of these forms of sciatica will be most rapidly effected when, in addition to the mechanical interferences, passive and active motions of all the affected muscles are employed. It has also seemed to me best to begin the daily treatment with the passive and active movements, leaving the mechanical manipulations, which are very painful, till the last. They cause so much exhaustion, as a rule, that the patient is anxious only for rest, and will hardly have the energy necessary for performing acts which he knows must only increase his suffering.

First Day of Treatment.—It should always be our endeavor to begin treatment with the simplest procedures, and to gradually advance to the more complicated ones. The simplest and easiest muscle-exercise for the patient will generally consist in flexing the thigh. As a rule, I found great difficulty in persuading patients to raise the thigh themselves even ever so little. It is better, therefore, to set a very moderate limit to the distance the patient is to lift his foot from the ground. Many observations have convinced me, too, that although there is sufficient

muscular power to raise the limb, and though the patients are gladly willing to bear the accompanying pain, still, owing to years of functional disuse, the cerebral power of causing the requisite contractions has actually been lost. I had long been of opinion that for the restoration of lost muscular function it is just as necessary to practise upon the cerebral as upon the muscular apparatus of the patient. This conclusion I had arrived at even before I could satisfy myself regarding a scientific explanation for it. An explanation, however, is fully afforded by Du Bois-Reymond's hypothesis, already considered, namely, that muscle exercise is, in reality, brain exercise.

The localization of the cerebral centres of certain of the special senses has long been known; but those of many of the higher functions, as speech, for instance, have only been determined more recently. Between the brain and muscular movements an intimate relationship must certainly exist, so that long-continued suspension of the muscular action of any limb must cause atrophy of the corresponding cerebral area. A most interesting case in point has very recently been reported, and deserves repetition here.

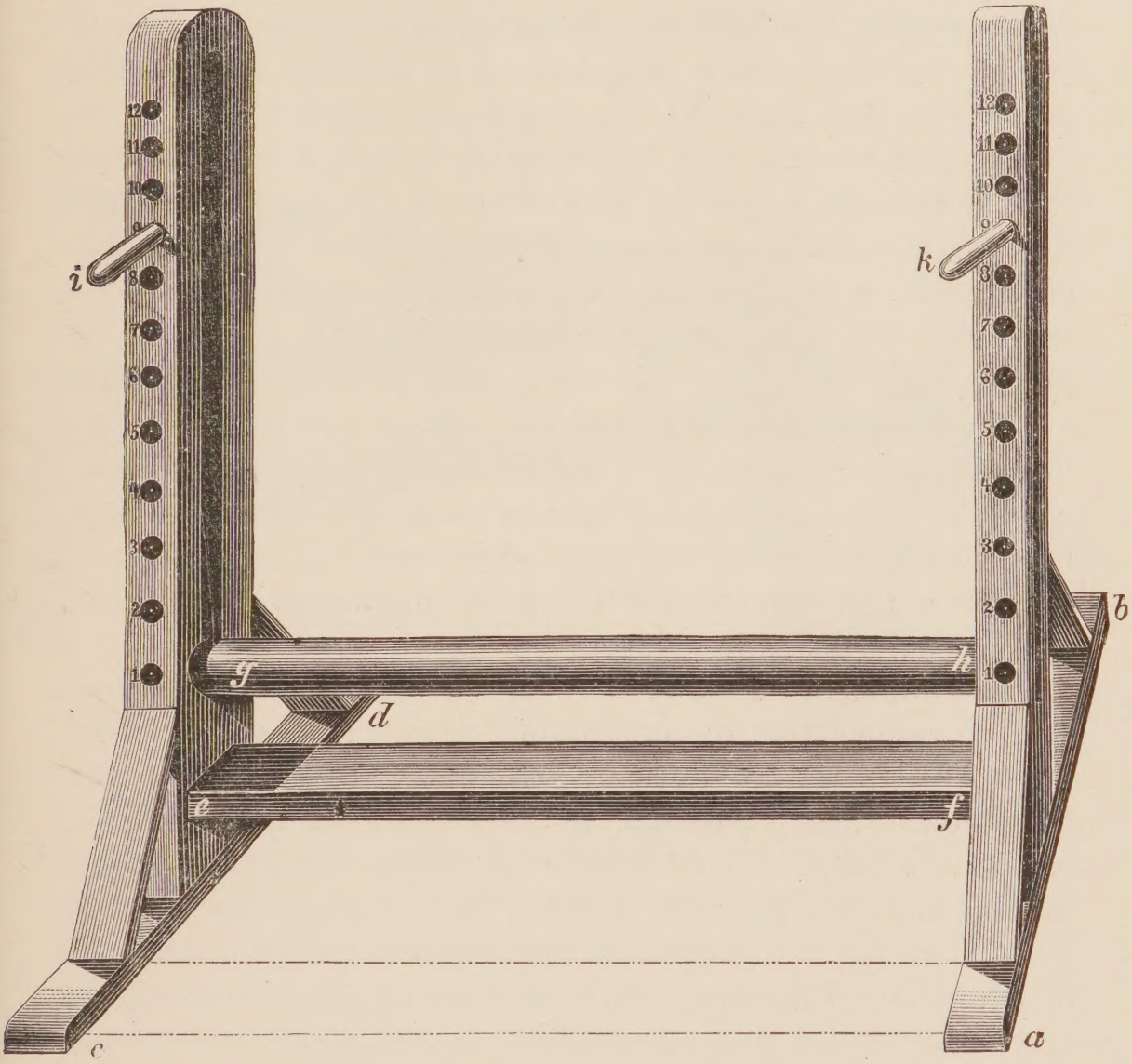
In 1882, Reymond[1] performed an autopsy upon a man, aged thirty-one, dying of tuberculosis in the Hôtel Dieu in Paris. In 1870, the patient had had his left arm amputated, and had also lost the index and middle fingers of his left hand. The case was used by Reymond to determine what influence upon the motor tracts of brain and cord, the loss of function caused by the absent members could have had. No macroscopic changes in the cord could be discovered. In the brain, however, a difference between the two hemispheres was at once noticeable. The convolutions in the motor areas of the left side were perfectly normal, while the right ascending frontal and parietal convolutions were flattened, sunken, and atrophied, their volume being four-fifths smaller than those of the left side. All other parts of the brain were normal.

The simple form of horizontal bar, here figured, will be found to answer all purposes. It should be so constructed that the bar *gh*, resting on the pegs *ik*, can be placed closer to

[1] Reymond: Progrès médical, 1882, No. 24.

the floor than is the case with ordinary horizontal bars, and the uprights should be firmly braced by supports.

Fig. 30.



The patient stands in front of the bar (which should be placed at the lowest hole, about twenty centimetres [eight inches] from the floor), the physician being opposite and giving his hands for support. The affected limb is then to be raised at the word of command, and the foot placed upon the bar. Although supported, the patient will often be unable to obey. He should then be directed to steady himself by grasping an upright with either hand, while the physician, raising the limb, places the foot upon the bar. After being left thus for from one to three minutes, the command to put the foot on the floor

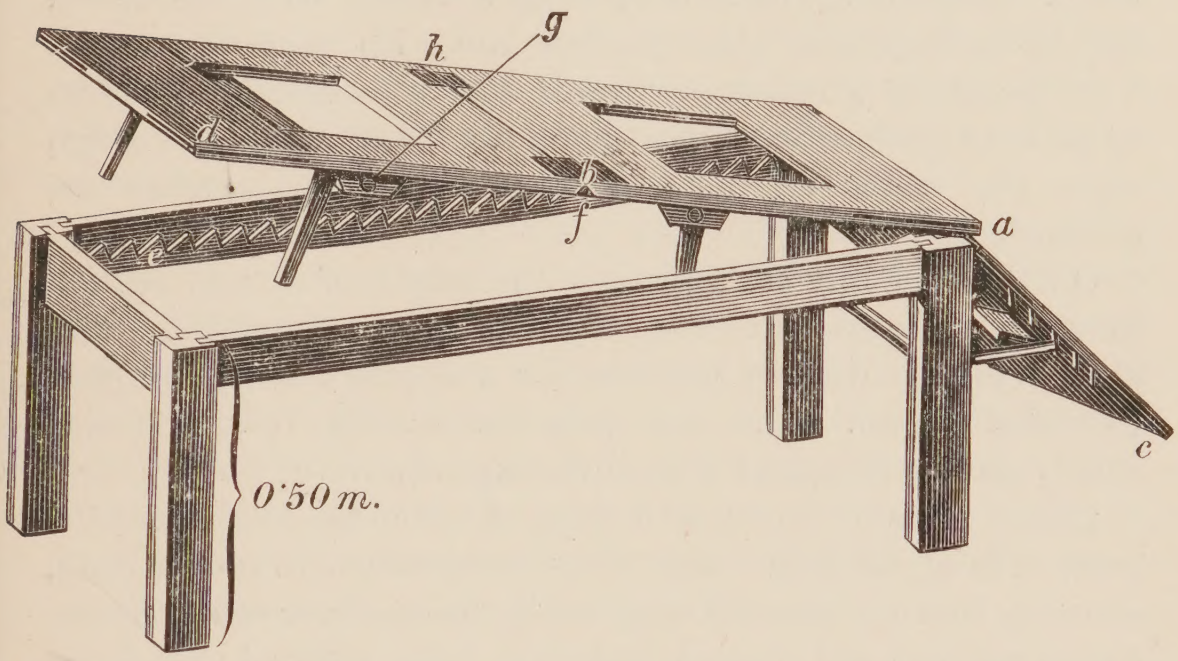
again should be given, but even this motion—intended to act upon the gluteus maximus—may be impossible, in which case the limb must again be raised by the operator and the foot replaced upon the ground. This passive motion of raising and lowering the limb should be repeated ten times, it being left to the physician's judgment how rapidly it should be performed, how high the leg should be raised, how long the foot should remain, and how forcibly it should be placed on the bar in order to get the best effects of the resulting concussion of the muscles and nerves of the thigh and buttock. The patient can never be injured by *too much* exercise. On the contrary, the duration of treatment will be shortened by proceeding vigorously. Nevertheless, personal peculiarities must always be taken into account. Some will prefer to have the time shortened even though they suffer more in consequence, while others elect a form of treatment which, although less painful, necessarily occupies longer time. It often requires no little experience and knowledge of human nature to decide upon exactly the right thing.

I feel impelled to allude once more to the advantages which may be gained from the horizontal bar as a means of stimulating muscular energy that may have been lying dormant even for years. Many patients, as before stated, even in spite of every effort, are unable to raise a foot from the ground. When, however, they are ordered by the physician to place one foot on the bar (which should be placed as low as possible) it will be found that they will often succeed, even without help. It will be noticed that the patient, in raising his foot does so hastily, seeking to aid the motion by leaning forward, his eyes meanwhile being kept fixed upon the bar. It will not be possible, however, for him to maintain this position, for the glutei are being called upon to fix the pelvis upon the heads of the femora and to keep the trunk upright, which in their enfeebled condition they are unable to do. Hence, if no assistance be offered to the patient, he will either fall, or seek to prevent this by grasping the uprights, or by throwing the body backward and to the left to bring its weight upon the sound limb. The significance of the latter position should be well under-

stood, in order not to fall into the error of supposing the patient now able to stand on both legs.

When this first difficult exercise has been completed passive motions, and finally mechanical manipulation, may be resorted to. For the latter a special bench, which any carpenter can make, should be used.

Fig. 31.



The seat consists of three adjustable sections, so joined by hinges that section *a c* can be lowered, while sections *a b* and *b d* may be raised; each section being held fixed at any desired angle by ratchets placed as shown in the cut. The seat must be covered by a similar sectional hair mattress, made about eight centimetres [three inches] thick.

The seat having been made plane to begin with, the patient lies at full length on his back upon it and executes on the first day those motions which were previously performed standing. Then the passive exercises (raising the thigh) are undertaken by the attendant, the right leg (it is a case of right-sided sciatica we are supposed to be treating) being grasped in both hands, and the thigh flexed upon the pelvis, so that the knee is brought toward the chest. At first the maximum amount of flexion should not be attempted, owing to the intolerable pain it would cause. Altogether, it will be well to observe much gentleness in the beginning, as too vigorous methods, by caus-

ing the patient great pain, tend to destroy his confidence in the physician, and to deter him from proceeding with further treatment.

When the patient raises the thigh the iliacus and psoas magnus contract. When passive motion is used, on the other hand, these muscles remain relaxed, while the sciatic nerve is stretched in proportion as the knee is made to approach the chest. Stretching the sciatic, without laying bare the nerve, has been frequently attempted of late with varying success. The operation, which is performed during anæsthesia, consists in producing the maximum amount of flexion of the thigh upon the trunk—until the dorsum of the foot touches the patient's face.

On the first day of treatment the angle of forced flexion must not exceed sixty to forty-five degrees, and the thigh should be kept in this position for a moment only, and then extended again. The manipulation should be performed slowly and quietly, and with little expenditure of force.

I have occasionally treated cases in which the muscles of the inner side of the thigh were those most sensitive to handling, showing that the muscles supplied by the anterior crural nerve, (psoas magnus and iliacus) were even more affected than those supplied by the sciatic.

I always repeat each passive motion ten times, directing the patient to count with me, and although the latter observance may on first considerations seem a little childish, yet it will be found, by diverting his attention from himself, to serve a very useful end, for you may be very sure he will keep accurate tally to see that the promised ten rounds of pain are not exceeded, and the moral effect, which the assurance that as ten is counted his tortures will be over, has upon the mind, far exceeds any personal influence which the physician can possibly bring to bear. Indeed, the patient often feels a pride in completing the magic number, ten, in spite of sufferings, generally heroically concealed, and often denied. The physician should always keep in mind how much of his success depends on tact, perseverance, and moral influence.

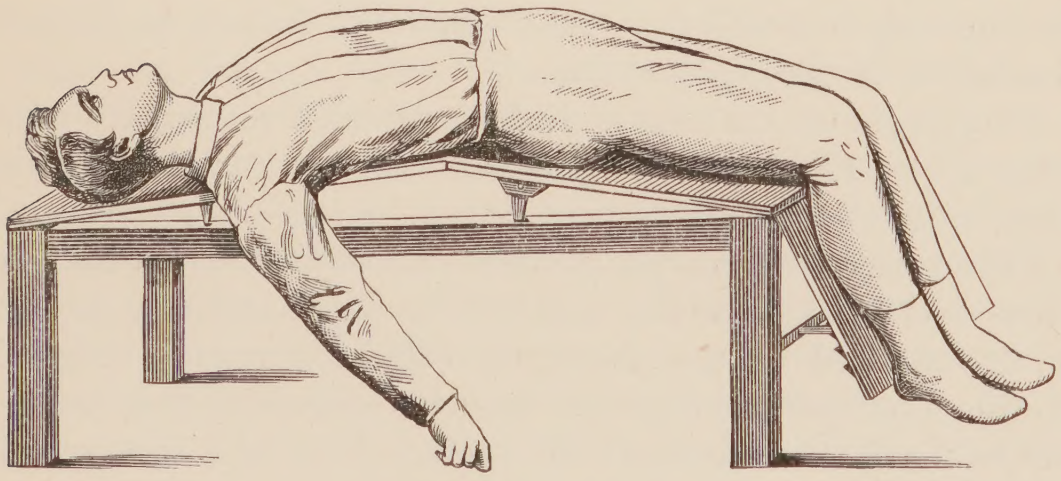
The passive exercises having been completed, mechanical ones may be next attempted, for the first day of treatment

serves as a sort of general introduction, and to accustom the painful parts to the touch of the manipulator's hand. It will be enough for a beginning to knead gently over all the muscles of the thigh and buttock as high up as the origins of the glutei, and along the crest of the ilium (where the glutei are generally most sensitive), using the tips of the first, second, and third fingers, as shown in Fig. 3. As each part should be gone over at least ten times, the whole procedure will take from eight to ten minutes, and it is best when halfway through to give the patient a rest of two or three minutes. This he should also have between the active, passive, and mechanical exercises.

The physician must not allow any expressions of pain on the part of the patient to alter his original programme. Should the patient not possess enough moral courage to observe the necessary quiet, he must, if necessary, be held; if possible, by some member of the family possessed of the requisite authority and force, rather than by an attendant of the physician.

The pauses between the various kinds of treatment may be used to seek to influence the disease by lying upon the bench in certain favorable attitudes. (See Fig. 32.)

FIG. 32.



The foot-piece should be lowered, allowing the legs to hang over the edge, and thus exerting a gentle traction upon the muscles connecting the pelvis with the thighs and legs. These muscles, hitherto inactive, will in this way receive a certain

amount of stimulation by their nerves being slightly stretched (which may cause some pain).

The patient should wear a costume such as has been described. Inunction is unnecessary.

The above manipulations complete the first day's treatment, at the end of which the patient will generally complain of much pain and fatigue. Sometimes a rise from 0.5° to 1° C. in temperature can be noted, accompanied by increased rapidity of the pulse. The pain, which during the active manipulation may have been very severe, usually diminishes considerably in about half an hour; occasionally, however, lasting for hours after. In the beginning, too, the nights—always dreaded by sciatica sufferers as the time when painful attacks are most frequent—may be even more broken than before. The physician should warn the patient of this, lest in alarm he be deterred from proceeding with the treatment. In six to twelve days usually a change for the better occurs, the nights become more tranquil, the pain is less, and the first signs of approaching convalescence begin to appear.

Second Day of Treatment.—It is almost a matter of course that the physician will be confronted with every kind of doubt on the part of the patient, regarding the ultimate results of treatment, but as failures are rare where sufficient perseverance and the requisite skill have been employed, he may confidently combat these misapprehensions.

Programme for the day. 1. Repetition of yesterday's exercises at the horizontal bar (thigh-lifting, ten times), placed at same height as before.

(The patient will rarely be more successful than on the previous day. Should active motions be impossible, the passive form, executed by the physician, will be required. Should, on the other hand, the patient be more successful than before, the bar may be raised to the second hole and the exercise repeated.)

2. New exercises, involving the abductors and adductors of the thigh (the glutei, the gracilis, the adductores longus, brevis, and magnus, and the pectineus).

Order the patient first to abduct and then adduct the affected limb. This, like lifting the thigh, may be done either while

standing or lying. At first sight, it might seem as though it could be more easily performed lying down, because in the erect position the glutei are obliged not only to abduct the thigh, but to maintain the trunk upright on the heads of the femora. Experience, however, shows the opposite to be true. If adduction be attempted while standing, it will be noticed that the patient first transfers the weight of the trunk to the sound side by leaning in that direction, and at the same moment, while balancing himself with the arm of the affected side, he allows the limb rather to fall outward by its own weight than to adduct it by any actual contraction of the affected muscles. When lying on the back, however, the motion can only be performed by means of the glutei. In the beginning, imperfectly performed exercises must often be allowed to suffice. A certain amount of participation by the disabled muscles must occur, however much the sufferer may seek to avoid it, and try, in spite of every longing for a cure, to deceive both the physician and himself.

If, in spite of every effort, independent attempts at abduction and adduction should fail, the physician standing opposite the patient should support him by grasping both hands in his. Should this aid still be insufficient, he must be directed to steady himself with both hands at the uprights of the horizontal bar while the movement is performed passively the usual ten times. After this, active and passive flexion, abduction and adduction, performed lying upon the bench, should follow. It may be well to remark here that these motions can often be more easily accomplished if performed simultaneously with the sound limb. The pauses should be used to allow the patient to lie with his legs over the end of the bench upon the depressed foot-piece, as before alluded to, in order to exert traction upon the affected muscles. At first the angle should not exceed 135 degrees, but little by little it may be diminished, until finally the legs hang at right angles. Traction may be still further increased by placing the head-piece of the bench at an angle to the middle section (Fig. 32). In this position the pelvic muscles are put upon the stretch, and the greater the inclination of the sections to each other, the greater the amount of extension.

Mechanical manipulations should now follow, beginning with the same kneading as yesterday, only executed somewhat more vigorously. Mild pinching also may now be introduced (see Figs. 14 and 15). For the physician this is one of the most tiring of all the manipulations, especially when performed upon muscular or corpulent individuals. For the regions of the buttocks, the outside, front and inside of the thigh, I commonly use both hands conjointly placed side by side. As this particular manipulation—whose object it is to reach the deep-lying muscular layers—is an extremely painful one for the patient, it may be necessary, during its performance, for an assistant to steady the limb upon the bench.

Third Day of Treatment.—To avoid constant repetition, it may be stated here, once for all, that each day's programme always includes the whole of that of the previous day. I therefore only describe the additions made each day.

The bar being placed at the lowest hole, we order the patient to raise his foot and place it on the other side of the bar, and to keep it there from half to one minute before returning it to its original position. Generally, in the beginning at least, he will need to be supported by the hands. Should he be unable to accomplish the exercise at all, it will have to be performed for him (ten times) by the physician, while he supports himself, as before, by the uprights of the bar. Kneading with the knuckles, as shown in Fig. 5, is the additional mechanical manipulation for the day.

Fourth Day of Treatment.—First, placing the *sound* foot upon the bar; secondly, stepping over the bar with the sound foot.

This exercise involves a decided change in the treatment, it being easier for the patient to lift the ailing limb for a moment, than the sound one. For when the affected limb is raised the body is supported on the sound one, whereas, when this is raised, the burden of maintaining the body upright falls upon the affected glutei and all the other muscles connecting the pelvis with the thigh and leg. Support will generally be needed.

The new mechanical manipulation consists in "thrusting" the thick muscle layers. (Fig. 7.)

Fifth Day of Treatment.—Every second or third day the bar should, if possible, be raised one hole higher.

New exercise: Sinking the knee upon a cushioned stool, the right and left alternately, and remaining thus half to one minute,—first with, later without support.

Passive flexion of the thigh is to be executed, with daily increasing force, the knee being brought nearer and nearer to the chest. In extension, the thigh should be, as it were, hurled upon the bench again with considerable violence, which produces often a very painful degree of tension in the nerve. At this period of treatment the patient will, as yet, be unable either to lie down upon the bench, or to rise from it in a natural manner. In attempting to lie down he first lies upon the sound side and then, with help of the leg and arm of that side, pushes himself toward the middle of the bench, and then rolls over on his back, the ailing limb, meanwhile, being held in the characteristic position. It will be noted, too, that while lying on the bench the right (affected) buttock is scarcely allowed to touch the mattress, the body being supported on the left, and being, consequently, turned somewhat toward the sound side. It frequently takes from six to eight weeks before the normal positions assumed in lying, sitting, and standing are resumed.

Sixth Day of Treatment.—First, sinking with the right knee upon a cushioned foot-stool, and remaining thus. Then the same motion performed with the well knee. This is always the more painful and difficult exercise of the two for the patient. Support must be given if necessary.

The patient then lies upon the bench, and a mild form of muscle hacking (see page 61) is used for the first time. Care must be exercised to avoid striking over bones, as these are often very sensitive, hence this manipulation cannot be properly performed by any one ignorant of anatomy. The manipulator should be perfectly familiar, even on the clothed body, with the location of all the bones of the hip, thigh, and leg; and both in men and women due consideration must be paid to the genitals, especially since certain muscles, as the psoas, iliacus, and pectineus, which are inserted into the lesser trochanter and consequently in the immediate neighborhood of

these organs, are often the seat of obstinate pain. No form of manipulation is so potent, so far-reaching in its effects as muscle hacking, provided, always the patient is able to endure the pain. On well-developed individuals it should be performed with the full power of the arm, and it is not at all uncommon to find ecchymoses produced in consequence. These ecchymoses, though often alarming enough to the patient and his friends, should not influence the physician for a moment, as they have no bearing either upon the progress or duration of treatment. On the contrary, they are to be regarded as rather favorable than otherwise. As in pannus, the inflammation resulting from the use of irritating applications produces a resorption and clearing up of the thickening and opacity of the cornea which had perhaps resisted all other treatment, so old exudations in and about joints may be made to disappear by the inflammation set up by the straining and tearing of the parts caused by vigorous mechanical treatment. In a similar way these hemorrhages produced in the skin, and no doubt also in the muscular substance, lead to an increased circulatory activity and metabolism, and hence to a more rapid removal of those products of tissue disintegration which had hitherto been retained in the muscles and nerves. At any rate, I have always noticed that in a few days after the resorption of the extravasated blood, the exercises were accomplished both with greater ease and with less pain. The physician should, however, make it a rule to undertake no species of mechanical manipulation upon the parts until the pain and discoloration of the skin, resulting from the ecchymoses, have disappeared, and it would be well, too, to give warning beforehand of the probability of their occurrence, in order to guard against alarm and dissatisfaction on the part of the patient.

Muscle hacking, like all other manipulations, is much facilitated by the patient's assuming a position favorable for its execution. In some cases the physician will find it best to stand on the sound side, in others on the affected side. Thus when the muscles of the inner aspect (iliacus, psoas, adductors, pectineus, and gracilis) of the thigh are to be hacked, he must stand on the affected side, beginning the hacking at the knee carrying it up toward the pubis. The thigh, meantime,

being slightly abducted, and the knee bent, in order that the least amount of resistance may be offered to the edge of the manipulator's hand. The glutei, the biceps and extensor quadriceps cruris—that is, the muscles of the buttock, and of the back and front of the thigh—can be as conveniently reached from one side of the patient as from the other. For efficiently attacking the origins of the semimembranosus and semitendinosus muscles it will be necessary to stand on the affected side, and the patient must lie prone, with his legs well apart. In the beginning an assistant is usually required to keep the well limb drawn to one side. In regions where bone is but thinly covered with muscle, a very mild form of hacking must suffice, whereas, where a layer several inches thick intervenes much force may be used. Beginning at the crista ilii, the force employed should be gradually increased as the tuber ischii is approached; from here downward it should be again diminished. The same method must be observed in going from the trochanter to the knee. Attention, too, must be paid to the horizontal ramus of the pubes.

As muscle hacking is the most painful of all manipulations, it should always form the close of the day's treatment.

Seventh Day of Treatment.—Active and passive exercise of the external and internal rotators.

The best means for the patient to accomplish external rotation is, while standing erect, the heels being close together, to try and turn the toes out as far as possible. The angle thus formed will, at first, be small, but it will gradually increase in size, until finally the feet are almost in a straight line. For the internal rotators, the opposite exercise is indicated. The heels being separated, an effort is made to turn the toes out. The knees must be kept straight, for when bent, the movement of the feet can be accomplished entirely by rotation of the tibiæ.

An exercise combining the use of the rotators and the abductors and adductors is performed as follows: The patient standing first with the feet close together, separates the toes and heels alternately, until the legs are at their maximum degree of separation, when they are to be brought together again

in a similar manner. The muscles of the calf are also necessarily used, but this is no objection.

Passive movements follow next; passive external rotation being best performed with the patient sitting, as shown in

FIG. 33.

Fig. 33. Downward pressure is then made by the hands placed upon the knee. This operation is so painful that it must be begun very gently, and only after a number of days, usually, is it feasible to increase the amount of force. The exercise on the bench consists in the physician crossing the patient's legs for him.

The order of the mechanical manipulations is not to be changed from this period until the cure is completed. It is as follows: First, pressing and kneading (the fist will have to be used for the more fleshy parts), producing so-called vibrations. Second, pinching and hacking. The amount of force used should be increased a little daily. It will be noticed that the patient's sensibility usually becomes much less by the end of the first week, and that the pains begin to decrease,

also that certain motions, hitherto impossible, can now be performed, even though clumsily and with trepidation. Sitting down, as well as standing perfectly erect, will still be difficult. The carriage also will be faulty and only in the physician's presence does the patient attempt to correct it. When unobserved, but little change will probably be noticeable. Sleep, however, is better, and the nocturnal attacks of pain less frequent and severe.

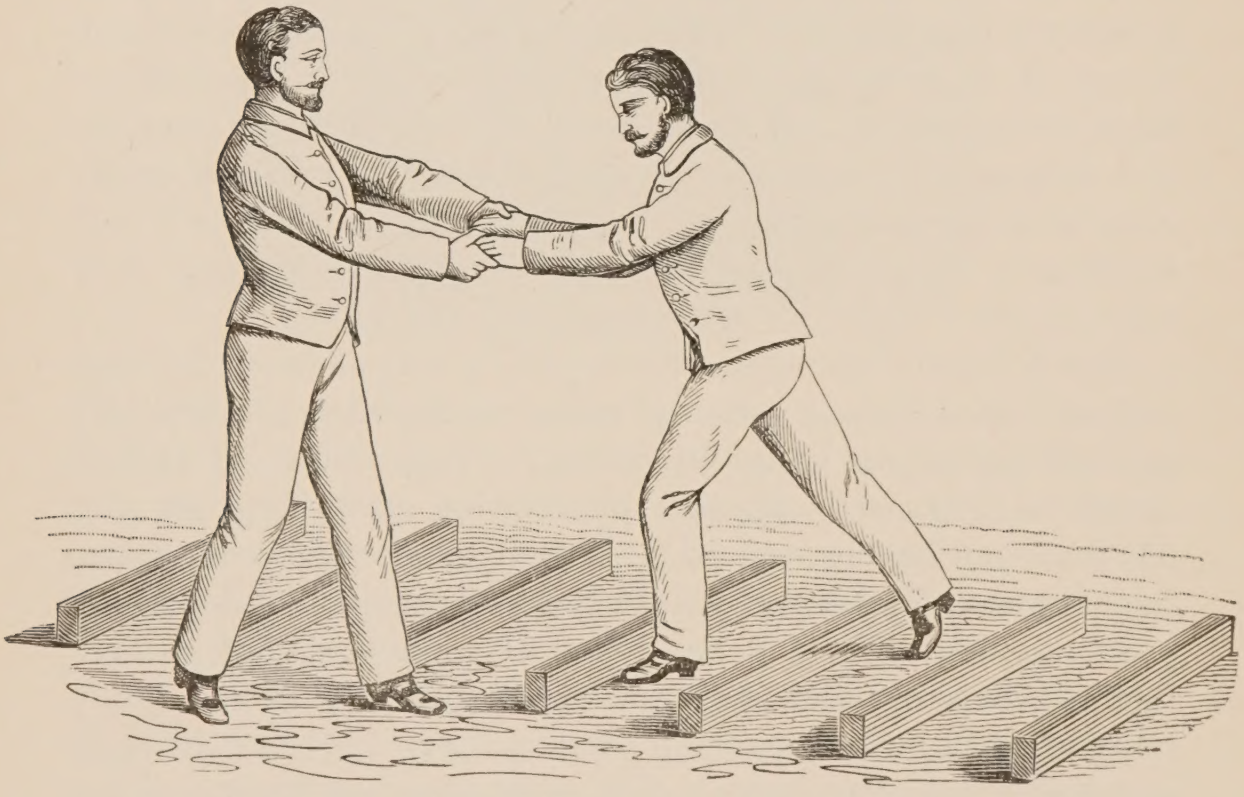
Cases occur, though, in which a week's treatment makes not the slightest impression, so far as reducing either the pain or the disability goes. Indeed, all the symptoms may become aggravated. This, however, should be no cause for discouragement, and treatment must be consistently persevered in. In the severer cases, of course, where convalescence is protracted, the number of mechanical manipulations possible will be small, while the employment of active motion may be entirely out of the question. Nevertheless, the labor expended will not be in vain. It will have been, so to speak, stored up in the muscles, and it may all at once make itself evident, for after the second or third week a number of motions will suddenly become possible in a surprisingly short space of time, the final result of treatment thus remaining the same. From long experience I can confidently say: Be patient and persevere! Success will come at last!

Eighth Day of Treatment.—If everything has gone well, the time will now have come to attempt some combination movements, as walking, sitting, lying, straddling, and squatting. The first lesson to learn will be that of walking properly,—for the patient from having walked faultily so long will have to learn the art anew, for he really does not *walk* at all,—at least not physiologically. In the physiological walk the body is first inclined forward; this shifts its centre of gravity from a point lying on a line which passes vertically down between the feet, and we would consequently fall, were this not prevented by advancing one leg. The feet then rhythmically replace each other, and although the time in which this alternation occurs varies from the slowest pace, to the swiftest run, only one extremity at a time bears the body's weight. In our assumed case (right-side sciatica) the patient really walks only

with the left leg, dragging the ailing one after. For the toes of the latter will hardly have touched the floor, before the well leg will have made a step forward, the sufferer, meantime, transferring the weight of his body to a cane held in the right hand, so as not to allow the right leg to support the body an instant. Forcible means are in these cases often the most successful. The physician should grasp the patient by both arms and draw him forward. Thus taken by surprise, he will be compelled to take a step, and thus, with knees and hips bent, under protestations of pain, or even with tears in his eyes, he takes his first lesson in walking. Should, however, such heroic treatment seem inadvisable it will be best to leave the first attempt to the patient's own initiative.

By means of a very simple form of apparatus it is often possible to teach a patient to walk properly in a few days.

FIG. 34.



It will be noticed that he drags the right leg instead of raising it. Now, to overcome this I had a number of wooden blocks made—eight to twelve, according to the length of the room—1 long, 0.06 thick and 0.12 wide, (39 by $2\frac{1}{2}$ by 5 inches). These are placed at regular intervals upon the floor,

and the patient being drawn forward by both hands, is thus forced to step over the impediments in his way. The rhythm with which he does this will not be uniform in the beginning, the affected leg being naturally favored.

This movement is to be repeated ten times, the patient being always supported to prevent a possible fall, for even if the pain be overcome and the sole planted squarely on the floor, he still has no really secure footing as yet, but sways like a reed in the wind and would certainly fall if left to himself. It is necessary to impress upon him that he may rely with absolute confidence upon his assistant, who should closely watch his every movement. It would be a very great error to deprive him, even for a moment, either through carelessness, or in jest, of this expected aid, for it would influence all his subsequent progress.

I cannot help reverting here to Du Bois-Reymond's conception of the unity existing between muscle and brain exercise. The patient, though protesting his inability to make a single step, as soon as he has some definite object before him—in the shape of overcoming the blocks on the floor—raises his foot, thus involuntarily calculating, in his mind, their height and breadth.

These seemingly insignificant blocks of wood have been of the greatest service to me. By increasing the distance between each, by placing them either on their sides or edges, or by laying one on top of the other, they may be made to present a considerable variety of gradations. The patient should be made to walk over them both backwards and forwards, at first slowly, then fast, and, finally at the word *halt*, to stop, first when the well leg and then when the ailing one has been put over a block. Only when each command can be promptly obeyed may we assume that both muscles and brain have again learnt the art of walking. More difficult than walking itself, will be to halt for some time just after the affected leg has stridden over a block, because now this leg will have to bear the whole weight of the body; on the other hand—from a similar reason—the affected leg can be lifted over the blocks with greater facility than the well one.

The results achieved by means of this simple apparatus do not, however, become apparent quite so soon as the reader may have, perhaps, been led to believe. During the first

week or so, efforts at walking are still so painfully and clumsily performed that one might feel inclined to abandon all further attempts by this means. It should, however, be persevered in, for it is often not until the third or fourth week that the results become evident. Besides, every little progress made by the patient is watched by him with the greatest interest, and every newly acquired movement—which may for years have been impossible—is hailed by the family with the same delight as that with which they welcome the baby's first "papa" or "mamma," or his first tooth.

Further exercises consist in a repetition of all previous active and passive motions on the bench.

New exercises: flexing the lower extremity as a whole, the knee being extended. This is one of the most difficult of all the muscle exercises, for in addition to all the flexors of the thigh, the extensor quadriceps cruris is brought into action as well.

Ninth Day of Treatment.—The first exercises in seating are now begun. The patient must try to sit down upon a chair and rise again without the aid of his arms. A large number of muscles take part in executing this act, but the glutei especially are called into play to steady the trunk upon the heads of the femora. The attendant's aid will be necessary at first.

Upon the bench, maximum abduction is performed, the thighs being so far separated that the legs hang straight down at the sides of the bench. The weight of the legs stretches and extends the abductor and flexors of the thighs; a procedure which is as beneficial to the patient as it is usually painful.

Tenth Day of Treatment.—The time daily necessary for treatment (thirty to forty minutes) naturally increases with the number of exercises performed. Practice in *running* over the blocks for the first time, in the beginning assisted by the physician's giving his hand in support.

On the bench, the same movement as yesterday, only with the difference that the extremities are separated *violently*—in order to obtain the greatest degree of abduction—and then at once brought together again.

Eleventh day of treatment is to be observed as a day of entire rest.

Twelfth Day of Treatment.—Since, in running, the body is supported upon the toes alone, the muscles of the calf are necessarily forced to bear the weight of the whole body. In our course of treatment running forms the preliminary exercise to standing upon the horizontal bar. For the latter exercise to be possible for the patient, not only must the muscles have by this time gained greatly in power, but the sensitiveness of the nerves, also, have correspondingly diminished. From the many modifications of which it is capable, it will afford employment for many days.

In the beginning, we put the bar at the lowest hole, and then raise it one hole every day—or every second or third day, according to circumstances.

1. The patient, supporting himself by the uprights, steps upon the bar first with the well and then with the ailing leg, drawing the other after him, and then standing erect. 2. Putting one foot on the bar, he steps over it with the other, remains for a moment in this position, and then stepping back again. 3. With his back to the bar he raises himself alternately with the well and with the ailing leg, to the erect position, either staying in this position or stepping down backward with one foot, while the other remains on the bar. The execution of these different modifications, of which only one a day should be undertaken, will occupy five days at least.

For exercising the abductors, the patient is to set straddling on a chair.

On the bench, "thrusting" of the thigh while completely flexed, is to be performed.

Thirteenth to Twentieth Day of Treatment.—Repetition of all the different modifications of stepping on and over the bar. Sitting exercises (generally very hard for the patient). Repetition of all previous bench exercises.

Walking, running and kneeling exercises (kneeling first on a chair, then on a stool, and then on a cushion on the floor, and rising again, first with, then without assistance).

For the close of the daily programme, all the different mechanical manipulations.

Twenty-first Day of Treatment.—Second period of rest.

Twenty-second Day of Treatment.—On this day the execution of a combination-movement—as crossing the legs—is to be undertaken. These kinds of movements are the most difficult of all for the patient to perform.

The old idea, that the act of crossing the legs was performed by the sartorius muscle has been shown by Hyrtl to be erroneous. Both in the lying and sitting positions, it can only be brought about by the consentaneous action of the flexors and adductors of the thighs, and of the flexors of the leg. In accordance with Du Bois-Reymond's theories, combination movements (as the use of some tool, or of a knife and fork, etc.) require longer practice than simple movements, since the various degrees of contraction and relaxation must all be made to harmonize exactly. It is true that the act of crossing the legs, when compared to that of using a needle, requires but a low degree of dexterity; nevertheless it involves the successive or simultaneous contractions of at least three different groups of muscles. Even when after practice the long-forgotten movements of flexion and adduction of thigh and flexion of the leg, have once more been learned, the facility for successfully combining these motions may still be lacking.

Crossing the legs is more easily performed in the lying than in the sitting posture, because, when lying, the patient requires less force to flex the thighs. Nevertheless, it will still prove a slow and difficult operation, and the difficulties in the way of executing the necessary mental processes become very obvious. In nearly all the cases of chronic sciatica which I have treated, I have found this the very last movement to be correctly executed, requiring often three to four weeks' practice. In a few cases I have noted that the ability to perform it did not, as usual, become perfected gradually, though the patients gave themselves the greatest trouble for weeks to learn it. One fine day, however, when crossing the legs had to be performed as one of the regular exercises, they were able to execute it almost perfectly. The volitional impulse had, in these cases, been exerted for weeks, only the muscles had not comprehended it. All the other exercises,

however, had in the meantime been learned, all their various stages, from the most painful helplessness to faultless perfection, having been gone through.[1] In the beginning, crossing the legs must be performed passively, the patient both lying and sitting.

Twenty-third Day of Treatment.—The time will now have come to put the strengthened muscles and nerves to the final trial of their capabilities. This will consist in testing their ability to perform the act of leaping.

This act may be executed in every variety of gradation, as follows:

1. The patient (whose hands are grasped by the physician's for support) jumps with legs pressed close together, down from the horizontal bar placed at the lowest hole. The pain caused by the inevitable jar will be severe, and it requires considerable fortitude on the part of a patient with sciatica to undertake this act. The physician will be obliged to watch the patient's feet closely, for even the most conscientious patient will seek to catch the brunt of the body's weight upon the sound foot alone. The position of the feet may, at the same time, be so nearly physiologically correct that it requires a very practised eye to detect the deception. When the patient's attention is called to his delinquencies he readily admits them, and will generally strive to bear the necessary pain.

2. The patient performs abduction and adduction while in the act of leaping. The effort necessary for the upward spring serves to intensify the effects of these motions.

4. The patient, keeping the legs close together, jumps over the bar placed at first at the bottom hole, and gradually raised.

By raising the bar Nos. 1 and 3 may be modified. At first, a mattress should be placed to jump upon, and at all times the physician should be on hand to render assistance if necessary.

Twenty-fourth to Thirtieth Day of Treatment.—Repetition of all previous exercises.

Thirty-first Day of Treatment.—Day of rest.

[1] The translator would here recall his own analogous experience in trying to master a bicycle. For a week not the slightest progress was made. I was not able to stay on the machine for a single revolution of the wheel. Then on attempting it again one day, all of a sudden, I was able to ride any distance I might have chosen, apparently, without any effort —W. M.

Thirty-second Day of Treatment.—By this time the cane, which was for so many years the patient's trusty companion, will have been discarded, and going up and down stairs (the latter being always the more fatiguing) will now be possible without assistance. He will now be able, too, to kneel, or even to leap. Most of these actions are performed without any pain whatever, while in some there is still a certain amount of both awkwardness and pain.

Nocturnal pain has gone entirely, and in consequence sleep becomes natural once more.

The motions which will still be difficult and painful, are those of squatting, and of turning while lying.

During the act of squatting, with heels together and knees turned out, the maximum power of all the muscles of the lower extremities and pelvis is called upon. The external rotators of the thighs, with the gastrocnemius and soleus muscles, are in a state of active contraction, while the extensors, quadriceps crurorum, and the adductors are passively put upon the stretch. In addition, the glutei fix the pelvis upon the femora. To hop backward and forward, while in this position, is a pretty difficult feat even for perfectly healthy muscles and nerves, and its performance, therefore, in addition to the ability to cross the knees with readiness, may be regarded as the evidence of a perfect cure. In old people such result should be looked for, and the movement should not even be attempted.

The movement of turning over while lying is always performed by the patient in the direction toward the well side, and with the help of the arms, the ailing limb remaining inactive. Similarly it will be seen that it is upon the sound side that he lies, both when assuming the recumbent posture upon the bench, and when quitting it again. We therefore seek to force him to use the affected side in these actions instead of the well one, and the acquirement and practice of the necessary exercises will, therefore, occupy the balance of the curriculum of treatment, which may last in all from six to eight weeks. Meanwhile, the mechanical manipulations must be continued, until not a trace of sensitiveness remains. During the last few weeks, it will generally be sufficient to practise with the patient, who may now be fairly regarded as convales-

cent, every second, third, or fourth day. Only when all the exercises can be faultlessly executed can he be discharged as perfectly cured.

General Observations.

The line of treatment which we have been considering is, of course, only intended to serve as a general scheme, which will have to be specially modified for each case. If, for instance, instead of all, only certain muscles of the hip and thigh are affected, only such exercises as involve their use need be employed, and mechanical manipulations must similarly be directed chiefly to those portions most sensitive to pressure. It may be adopted as a good working rule that the difficult and painful exercises are the ones which ought most to be practised.

The duration of the treatment will depend on various factors:

1. On the previous length of the illness.

The longer the disease has existed, the more protracted will have to be the treatment. Eight weeks will, as a rule, be the limit,—at least that was the time needed to cure one of my cases, of a previous four years' duration. Cases of only a few months' standing often need but ten or twelve days for a cure. No fixed time, however, can possibly be laid down, for it may happen that a recent sciatica will take twice as long to cure as an old one.

2. On the extent of the disease.

The greater the number of muscles involved, the more numerous must the number of corresponding exercises be, and hence the longer the time required. However, this rule, too, has many exceptions, extensive neuralgias being sometimes cured in a short time, while localized ones may tax to the utmost the patience of both physician and patient.

3. On idiosyncrasy.

In sensitive individuals it is often necessary to proceed very cautiously and gently at first. More time is therefore required in these cases than where the patient is not of a timorous or complaining disposition.

4. On the skill, the experience, and the perseverance of the physician.

Familiarity with the methods frequently enables a practised hand to employ many devices which an inexperienced person very properly avoids, just as boldness in an old surgeon is more justifiable than in a young one.

5. On the age and general nutrition of the patient.

These two factors affect the results of mechano-therapy in the same degree as they do all other forms of treatment. In old and degenerate subjects, the changes in the muscles and nerves, which we seek to bring about by mechanical means, are, of course, more difficult to effect than in the young, yet I have often treated patients over sixty with the very best of success.

ON THE ADVISABILITY OF PATIENTS UNDERTAKING EXERCISES OTHER THAN THOSE PRESCRIBED BY THE PHYSICIAN.

This a question which, very frequently, will be raised by the patient himself. I have, however, come to the conclusion that it is best not to undertake any independent therapeutic exercises. For, in the first place, their repetition could only be of use if performed within the succeeding twenty-four hours, and few patients have moral courage enough to go through the necessary pain without the stimulus of encouragement from the physician. Then, too, they are very apt to be performed in a bungling and incomplete manner.

Mechanical manipulations should not be performed oftener than once a day. On the other hand, the patient can contribute greatly toward his own cure by striving, as soon as he is at all able, to observe and correct all faulty movements of such various acts as walking, sitting, lying down, rising, or going up and down stairs, etc. Yet, in spite of all, it will be seen how quickly reversion to the faulty carriage, which has become the habit of years, takes place as soon as his attention is diverted from himself. I have often noticed how such patients, when reminded, would go up stairs quite correctly—that is, placing one foot after the other on succeeding steps—but that as soon as their attention had been diverted by conversation, and the

will-power thus withdrawn from the affected muscles, they unconsciously fell into the old way of putting the well foot upon a step and drawing the ailing one after. In these cases, those surrounding the patient can be of much use by constantly reminding him of his faulty movements.

The same remarks hold good of sitting and rising. In sitting down both thighs must be flexed, and both buttocks touch the chair simultaneously, and the patient must not, as has been his custom, let himself down upon the sound side with the assistance of his arms. In rising also, the weight must be borne upon the affected limb.

The various cutaneous hyperæsthesias and anæsthesias, so frequently accompanying sciatica, invariably disappear under mechanical treatment, and the intensification, which often occurs in the beginning, need cause the physician no anxiety.

Cases.

Although all cases of sciatica have many features in common, nevertheless each will have its peculiar points of interest. I here present two—as types, of the unilateral and bilateral forms.

Case I. Unilateral Sciatica.—Baroness L. C., aged nineteen. In December, 1876, had scarlatina, followed by neuralgia in the left arm and cheek, and in the right lower extremity. Since then, though strong and hearty, had continued to suffer continuously from tearing, boring pains. In the autumn of 1877 walking became impossible. Prof. Knoll, one of the most distinguished clinicians of the University of Prague, who was at that time treating the patient, since told me that there then existed, besides left mental and cervico-brachial neuralgias, an area of pain corresponding to the region supplied by the right sciatic nerve, though not entirely confined to its distribution. The strictly localized neuralgias yielded very quickly to galvanism. The pains in the right leg, however, in spite of electrical treatment, both with the constant and interrupted currents, obstinately continued through the whole winter, till April, 1878. During the sum-

mer of 1878, the patient took thirty-six mud-baths at Elster, without any effect, nor did the electrization of the limb by Dr. Löber, the local physician, do her any good. In the winter of 1878 and 1879, Prof. Knoll again employed galvanism, but in vain.

During the summer of 1879, by her physician's advice, she drank Schwalbach water, and later went to Gastein, where she took twenty-eight baths. These seemed to benefit her, for whereas when she first came she had to be wheeled in a chair, she needed only a cane on going away. The pains, however, were as bad as ever; indeed, they had increased both in severity and constancy, until by October, 1879, she was scarcely a moment free from them. Paroxysmal attacks, also, lasting from seven till twelve o'clock P. M., made their appearance, robbing the patient of much sleep. The limb naturally became more and more incapable of use the less it was used; and finally it came to such a pass that she could not be induced to go to bed for months at a time, but would pass her nights upon a sofa or in an arm-chair.

It was while in this condition that the lady came to me. She could then only walk by the aid of a cane, and in going up stairs dragged the affected leg.

Treatment was begun December 13, 1879, and on February 2d, following, she was discharged cured. Before leaving she took part in a dance, a thing she had not done in years, and no one present was able to detect in any of her attitudes or movements a trace of her former trouble.

The plan of treatment described above was essentially the one followed in this case, without any interruption. On one occasion only, however, both the patient and I were threatened with having to abandon treatment, in consequence of extensive ecchymoses being produced from kneading and hacking the muscles of the buttocks and of the inside and outside of the thigh. This occurrence greatly alarmed both the patient and her friends, but a few reassuring words soon set matters right.

It was fortunate that the patient had been entrusted to the care of her aunt, the countess L., a sensible, energetic woman, who assured me that so painful a course of treatment would

never have been allowed at home, and that at the sight of the ecchymoses an end would have been put to it at once. And I take this occasion to say that many failures laid at the door of mechano-therapy are more rightly to be attributed either to want of perseverance on the part of the patients themselves or their families, or to lack of self-confidence on the part of the physician.

Case II. Bilateral Sciatica.—Before detailing this interesting case I may be allowed to preface it with a few explanatory remarks.

I passed the winter of 1880–81 in Paris, and as I had already for some years devoted myself to mechano-therapy, it was but natural that I should be specially interested in studying it in the great centre of French medical science. But so far as I could see, none of the attendants of the Paris hospitals or clinics employed mechano-therapy at that time.

Happening at one time to be at the Hôpital Necker, Prof. Blachez, the attending physician, invited me to make morning rounds with him. Upon coming to a patient lying upon his belly, Dr. Blachez said to me:

"What would you do in Vienna for a patient with sciatica, upon whom all previous treatment has been of no avail?"

"We would treat the case mechanically," I replied, "using both passive and active movements."

"Very well, the young man is at your disposal," the chief of the division replied, with a rather incredulous expression upon his face.

Of course, I was exceedingly glad to have this chance of visibly demonstrating in Paris itself the utility of the mechanical methods, for with few exceptions members of the profession there regarded the whole system either with dislike or indifference.

Eugene Mangeant, twenty-three years old; mason. In January, 1881, brought to Hôpital Necker, suffering from subacute rheumatic arthritis of the left knee and ankle, with moderate effusion into those joints. One year before had suffered pains along the shins extending up into the thighs. He dates his present trouble back to the winter of 1880, when,

after sleeping one night in a cold, damp room, he awoke next morning with pains in both legs. After the usual treatment the arthritic trouble disappeared, but there remained a bilateral sciatica (worse on the left side), which has resisted all kinds of treatment for the last two months and a half.

Examination shows numerous painful points on the buttocks and thighs, sensibility being especially acute on the nates at the emergence of the sciatic nerves, and along the crest of the ilium (origin of the gluteus maximus) and also at both tubera ischii. The left popliteal space is also very sensitive.

The pains, which have not changed their location for months, are most severe at night, but are never wholly absent. At three o'clock every morning they awaken him, and only gradually diminish about seven. Sleep is only possible in the prone position. As soon as awakened by the pains, he turns with difficulty upon his back by the aid of his arms, lying rolled partly toward one side, touching the bed with the right buttock alone, this being the less sensitive of the two. The left thigh is abducted, the left knee flexed, and resting partly upon the right one.

The patient is well nourished, and all functions are performed satisfactorily with the exception of micturition, at which he has to strain five to eight minutes before the stream can be started. The urethra being normal, there undoubtedly exists a paretic condition of the vesical muscles, easily explained through the anastomoses existing between the sacral plexus (which gives off the sciatic), and the hypogastric plexus, which sends branches to the bladder.

Walking and sitting are both impossible. Each thigh has extensive anæsthetic areas on the anterior and external aspects, reaching from the trochanters down as far as the middle of the calf. The prick of a needle, even when thrust its whole length into the part, is not felt.

To leave his bed—which he can only do with great pain—he raises himself with both arms and cautiously lowers his body as though it were a log. When placed seated upon a chair he rests upon the right buttock only. When an effort

to walk is made—which costs him the greatest exertion and pain—no active motion at the left hip-joint occurs at all.

I will omit the details of the exercises performed, as they were essentially the same as those used in Case I., contenting myself with giving a short account of the progress of the case from day to day.

On March 18th, the first exercises were begun, no mechanical manipulation, however, being undertaken on that day. I had requested the presence of the young physicians (*externes*) of the division, to act in the first place as assistants, and secondly, that I might make them familiar with the methods used.

March 19, *second day.* The past night was worse, the pains being more severe. To-day the first mechanical manipulations were begun. It was necessary for the externes to hold the patient during their execution. The manipulations and the muscle exercises combined produced considerable exhaustion, so that I begged that the patient might have daily, as a recompense for the pain endured, a quarter of a litre of wine.

20*th.* Pains even more severe; the patient not sleeping at all. Treatment continued nevertheless.

21*st.* In spite of continuous pain, slept a little last night.

22*d.* Pains diminishing; slept all night; he is now able, though only with much trouble, to get normally into bed. Active movements begin to be stronger.

23*d.* Complaining of increased pain, especially on the left side.

24*th* The night was easier, the pains being less; the walking exercises are quite satisfactorily performed, though the carriage is still faulty and the motions very timorous. Nevertheless, he can now flex the left thigh at the hip-joint. The right thigh performs its motions pretty well.

By chance I happened to surprise the patient about an hour after treatment. He was sitting on a chair in the old faulty manner; that is, on the right buttock, the left thigh being extended at the hip. On being reprimanded he at once assumed the correct position. I ordered him to go to bed

and rest his muscles whenever they felt tired, but when sitting, to sit properly. This should always be the rule.

25*th.* Bad night. The areas formerly anæsthetic have now become so hyperæsthetic (probably as the result of the mechanical manipulations) that he cries out when they are touched. When firmly grasped in the hand, however, or deep pressure made upon them, the pain becomes less, or gradually disappears, but as soon as the pressure is removed, the pain returns and the skin becomes as sensitive to touch as before. The pains in the nates, however, are much less severe than formerly.

26*th.* Day of rest; no treatment of any kind.

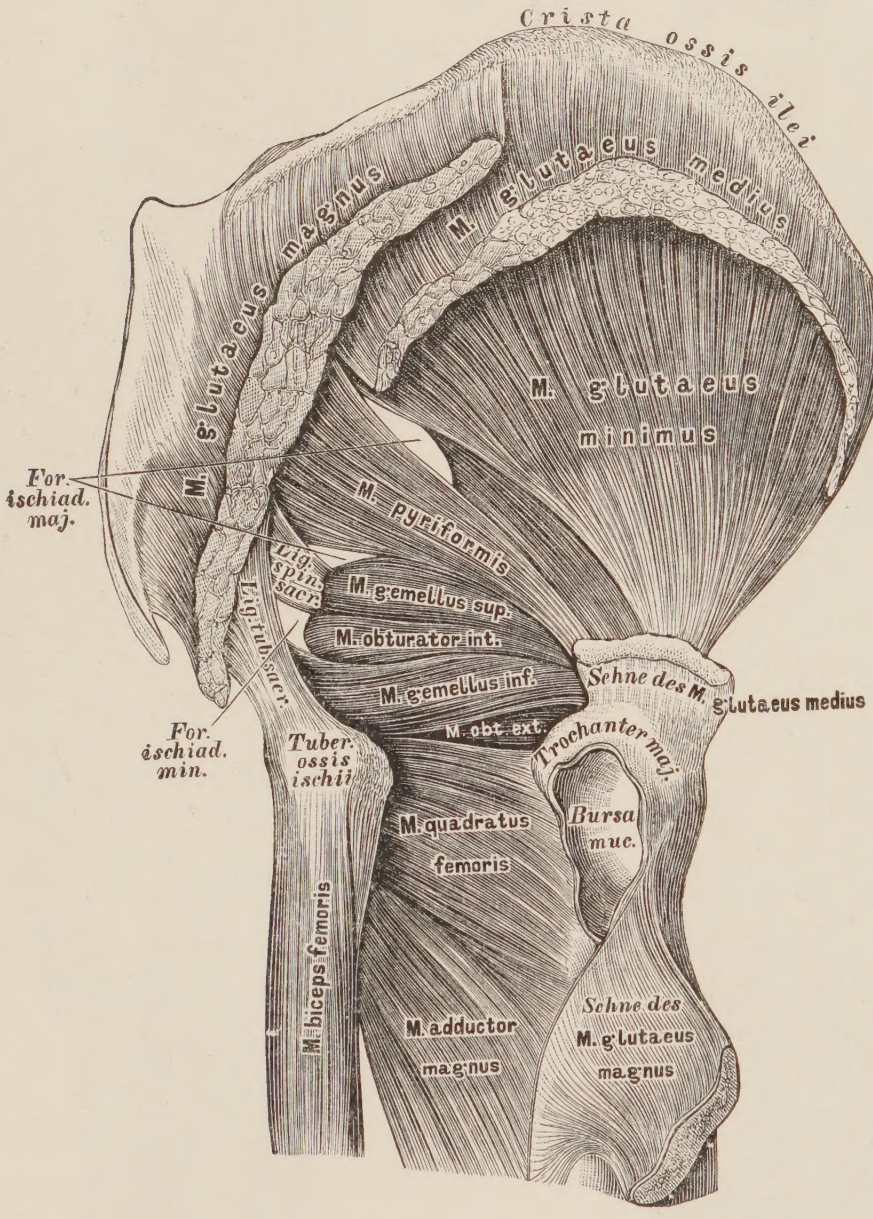
27*th.* Hyperæsthesia continues. The softest touch of the hand, even the contact of the shirt, causes pain, so that the patient cannot bear to wear any clothes. The sensitiveness on either side of the sacrum, at the ischial tuberosities, and in the popliteal spaces has, however, nearly disappeared. Two points on the nates, each quite symmetrically placed six centimetres ($2\frac{3}{8}$ inches) from the coccyx, and one on the left thigh about two centimetres ($\frac{3}{4}$ inch) above the trochanter, are still very sensitive. The anæsthesia which existed below the popliteal space has disappeared entirely, sensation there now being normal; micturition still as difficult as ever; general condition good.

(The three following cuts are introduced here simply to save the time of referring to an anatomical atlas. For the physician must always distinctly keep in mind the anatomical relations of the muscles to the bones, especially their origins and insertions, as these being very frequently the seat of the more severe pains, require, in consequence, a more severe form of treatment.)

Continuation of mechanical manipulations is rendered impossible by the extreme cutaneous hyperæsthesia. Micturition having increased in difficulty (it now takes fifteen minutes straining before the stream is started), and as Dr. Blatchez, in view of the bilateral distribution of the sciatica and the urinary difficulty, thinks it likely that the trouble is of central origin—which, indeed, seems not improbable—it is agreed to suspend all treatment till April 1st.

In the course of the four following days the patient's condition improved in the most astounding manner. The nights of March 27th, 28th, 29th and 30th, were still, on the whole, very bad, the pain being intense, but on April 1st he began to sleep well, the pains diminished, and the functional powers of the

Fig. 35.



muscles increased daily. The hyperæsthesia of both thighs disappeared entirely. Micturition, too, became perfectly normal.

On March 30, for the first time, he went up and down stairs without pain, and was able to walk about in the hospital garden for two hours without fatigue, and in an incredibly short time he returned to his normal condition, so that on April 4

FIG. 36.

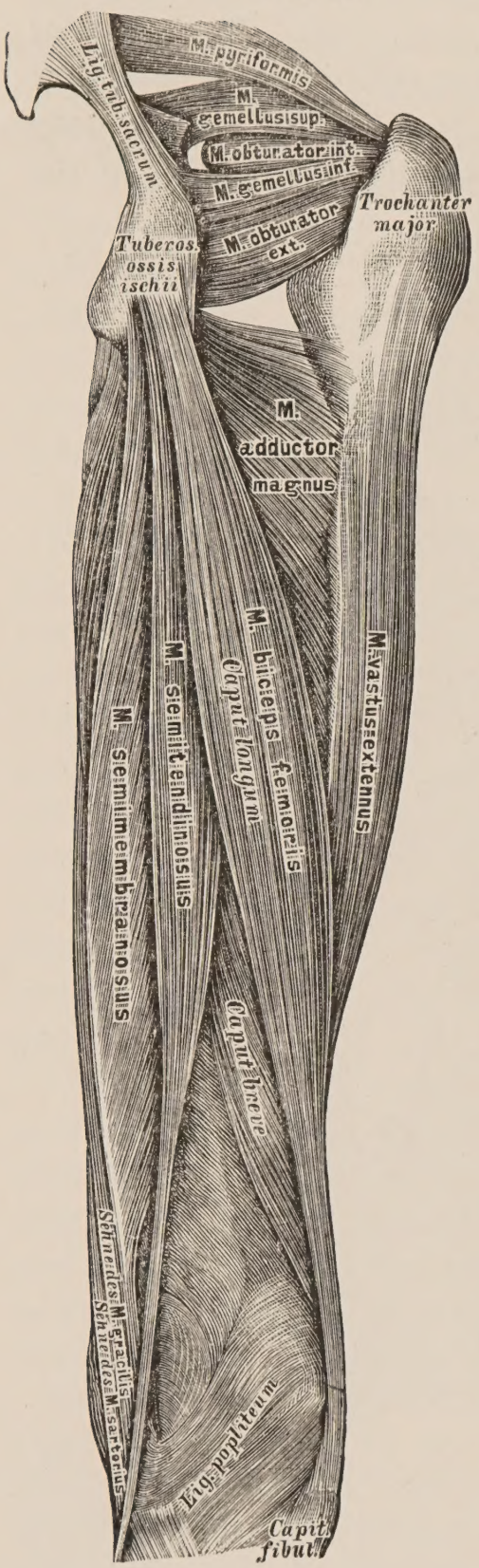
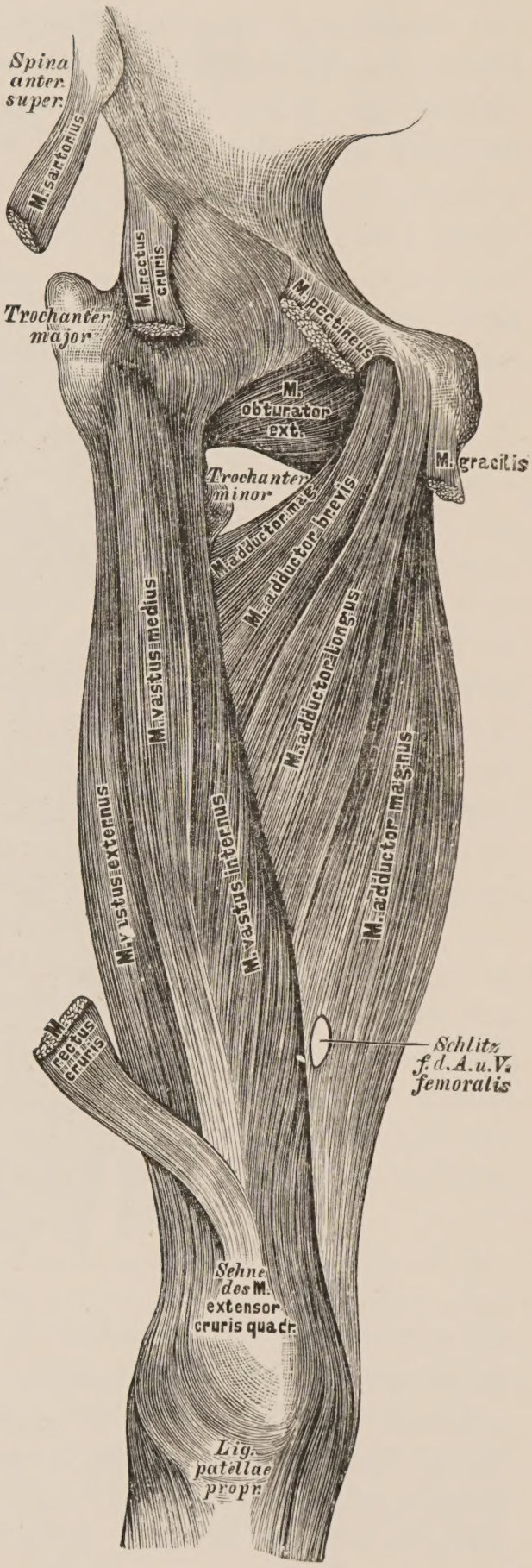

M. pyriformis
Lig. tub. sacrum
M. gemellus sup.
M. obturator int.
M. gemellus inf.
M. obturator ext.
Tuberos. ossis ischii
Trochanter major
M. adductor magnus
M. vastus extensus
M. biceps femoris Caput longum
M. semitendinosus
M. semimembranosus
Caput breve
Sehne des M. gracilis
Sehne des M. sartorius
Lig. popliteum
Capit. fibul.

FIG. 37.


Spina anter. super.
M. sartorius
M. rectus cruris
Trochanter major
M. pectineus
M. obturator ext.
M. gracilis
Trochanter minor
M. adductor mag.
M. adductor brevis
M. adductor longus
M. vastus medius
M. vastus externus
M. vastus internus
M. adductor magnus
M. rectus cruris
Schlitz f. d. A. u. V. femoralis
Sehne des M. extensor cruris quadr.
Lig. patellae propr.

—after sixteen days' treatment—he was entirely cured and could perform any desired movement with entire ease. All increased sensibility had disappeared, with the exception of two points on the nates at the exits of the sciatic nerves, where there was still a slight hyperæsthesia, scarcely worth mentioning.

In view of the extraordinarily favorable results obtained, Prof. Blachez at once ordered another case of sciatica—milder in degree than the first—to be treated by the young physicians of his division, whom I had been, meanwhile, instructing. They had assisted at the first patient's treatment, and were becoming quite proficient in the execution, both of mechanical manipulation and passive movements.

The result in the second case was as brilliant as in the first, and I think I may fairly assume that these successes of mechanotherapy have helped to convert many previous unbelievers in Paris hospitals. However, in German-speaking countries, too, the number of unbelievers is still pretty large, and I must confess to having myself belonged to that number but seven years ago. To be really convinced of the efficacy of this form of treatment, it is necessary to have actually witnessed some of its results. Even Busch himself, however, has his doubts upon its ultimate success. In his excellent treatise on the subject[1] (in which, it is true, neuralgia is but superficially touched upon) this eminent surgeon says: "The effects, however, are but transient, and we cannot hope to obtain lasting results from either gymnastics or massage, except, perhaps, in those cases where neuralgias are of hysterical, or hypochondriacal origin. In this class of cases a vigorous movement cure may not be without benefit." If Busch were to apply these remarks to trigeminal neuralgias alone, I would be willing to subscribe to them, but where it is a question of neuralgia having its seat within the larger muscles, I feel bound, in view of all my previous experience, to most decidedly differ from him, and there is nothing I more desire than the opportunity to prove my assertions by the citation of cases.

It may strike the reader as very remarkable, that the

[1] General Orthopædics, Gymnastics and Massage, in Ziemssen's Handbook of General Therapeutics, German Ed., Leipzig, 1882. Vol. V. Am. Ed., Wm. Wood & Co., New York.

case just described, which on account of long duration, great extent, and marked degree of functional derangement, was certainly to be counted among the severest forms of the malady, was cured in such a surprisingly short space of time. The cause of this is most likely to be found in the very energetic measures which I thought myself justified in using toward the patient, who was a strong, healthy young man, belonging to the laboring class. Had the patient been a delicate and sensitive young lady, surrounded by an anxious family, it would have been impossible either to begin the manipulations with as much force, or to have gone from one to the other so quickly, nor could the passive movements have been performed with as much vigor as they were. By treating the patient as I did, I certainly shortened the time of his suffering, and a letter overflowing with protestations of gratitude since received from him, gives me the quieting assurance that the energetic nature of my procedures redounded only to his benefit.

ON THE SUITABILITY OF MECHANO-THERAPY FOR RECENT CASES.

We all know how sciatica will disappear, often after only a few days' existence, perhaps, without any treatment whatever having been employed. This is especially true of those cases resulting from exposure, which generally yield either to the application of heat, or a vapor bath, or to cold water and friction. Several days, however, will always be requisite for a cure.

Where mechanical treatment is used in these cases, a cure is likewise obtained, only with the difference that the patient is able to use the limb again within twelve to twenty-four hours. Of course, not every patient will submit to the pain necessarily incurred during the treatment.

Lumbago, stiff neck, in fact, all forms of recent muscular rheumatism, may be treated in this way, but instead of describing each one in particular, let me give a case in point recently coming under my observation.

CASE III.—Mrs. M. H., aged twenty-nine. Frequent sufferer from supraorbital neuralgia. Of spare habit, and poor muscular development, but otherwise healthy. In August, 1882, I was called to see her, and found her suffering from pain so severe as to prevent her even turning in bed. She distinctly remembered having gone down into the cellar two day before, while in a perspiration. She was exceedingly desirous of being cured immediately, it being the time of year when she had the most work to do.

Examination showed both sciatic nerves to be affected. The muscles of the hips, buttocks, and posterior part of the thighs were not only rendered useless, but were extremely sensitive. A few painful points were found. The patient was unable to turn in bed, and lay moaning and complaining—as helpless as a block of wood. I proceeded to explain to her that there was, indeed, a very rapid cure for her malady, but that it was not of the kind that could be bought at an apothecary's; that, in fact, I carried it always about with me (and here I showed her my two hands); and that, although its application caused, no doubt, a good deal of pain, yet that the pain lasted but for a short time only. But I also told her that I could, on the other hand, guarantee that most likely on the very next day she would be able to be at her work at her wash-tub again. She answered she was ready to try anything, if it would only enable her to work.

I then began that series of mechanical manipulations so frequently described; beginning with stroking, in order to accustom her to the pain, and then proceeding to first light then hard pressing. After these came kneading, pinching, and finally hacking of all painful parts. It is, perhaps, needless to add that the pain thus caused was very intense.

Next, vigorous passive movements were tried, especially forced flexion of the thigh. The legs being bent, I brought my whole weight to bear upon the thigh, until the knees touched the body. This exercise is nothing more than a form of nerve-stretching, similar to that usually done under the influence of an anæsthetic. I repeated it ten times, and the sensibility of the nerves having now been deadened, I ordered the patient to turn over in bed ten times in each direction. She succeeded

in this, though, of course, at the expense of great suffering, and not without a little help from me. Then, taking the patient by both hands, I ordered her to rise; at the same time I stepped backward, and drew her forward, though she groaned with pain all the while. While in the upright position, I again began hacking the nates and backs of the thighs. Wherever it is desired to quickly restore a patient to the normal condition, hacking must be most vigorously prosecuted. Considerable amount of heat should be evolved in the muscles manipulated, for it is heat which in all probability brings about the desired molecular changes in the muscles and nerves.

After a quarter of an hour of continuous manipulation, the patient had become far less sensitive, so I ordered her to dress herself and ascend a neighboring hill, about five hundred feet in height, and up which a good path led. This she did, assisted by her husband, returning in about an hour. In the course of the day I repeated the pinching, hacking, etc., three times; also caused her to go through various motions, including seating exercises, for an hour each time.

When evening came nearly all the neuralgic pain had left her, and she was able to execute all movements with ease. The following day she was able to go to work, which she did with great rejoicing. After a few days all traces of former sensitiveness had left.

The possibility of curing lumbago and stiff neck in ten to fifteen minutes is well known, and according to my experience all recent neuralgias are equally curable. If the patient will only patiently submit to the treatment, the physician can conquer the disease. But—I repeat it again—treatment must be of the most vigorous kind. The physician who proceeds timidly, allowing the patient's cries and efforts to resist, to disturb him, cannot possibly employ the needed force, and in the end will only have tortured his patient and accomplished nothing. It should be our object to affect the muscles in their very deepest parts (always carefully regarding the bones), to stretch and concuss the nerves, and to cause an

evolution of heat and to stimulate the circulation within the tissues involved.

I have cured recent neuralgias in this way so often that I do not hesitate to assert that not only can the physician always get these troubles under his control if he desires, but that there is no other means which acts so promptly and certainly. Thousands of unhappy sciatica patients have been condemned to years of unbearable pain, and even atrophy of their muscles, simply because in the beginning they had not been treated on mechanical principles.

I know of but one objection that could be raised against this form of treatment. It might be said that perhaps these recent sciaticas would have yielded equally well to a mustard-plaster, or to a vapor-bath, or even to a few days' rest in bed. Of course this, as well as the opposite possibility, must be admitted; nevertheless, under the circumstances mechanical treatment can at least do no harm, while there is always the probability of its preventing the malady from getting a firm foothold in the system.

I had the misfortune myself to suffer for two years from an attack of sciatica, which resisted all ordinary forms of treatment. Finally on doing nothing, it disappeared of its own accord. Had mechano-therapy enjoyed at that time (1873) the reputation which it does to-day, and had I been so familiar with its powers as I now am, I need not have suffered, through two long years, the pain I did.

CERVICO-BRACHIAL NEURALGIA.

Cervico-brachial neuralgias, corresponding to the distribution of the four cervical nerves and a part of the first dorsal, affect the shoulder, pectorals, the arm and forearm, and the region over the spinous processes of the four lower cervical and two upper dorsal vertebræ. The painful points are numerous, and are distributed as follows: In the axilla, at the lower angle of the scapula, on the back of the shoulder, in the flexure of the elbow, and at the points of exit of the branches of the musculo-cutaneous nerve, and of the ulnar

nerve above the internal condyle; at the wrist-joint, and along the radial nerve. Marked exacerbations of pain sufficiently severe to rob the patient of sleep, are common at night.

Diagnosis is not always easy. In the first place, in the region involved, the areas of nerve distribution are hard to define; and secondly, it is a favorite seat of muscular rheumatism. However, even in the case of its being rheumatism only, we may all the more readily count upon the success of mechanical treatment, for myalgia is even more amenable than neuralgia.

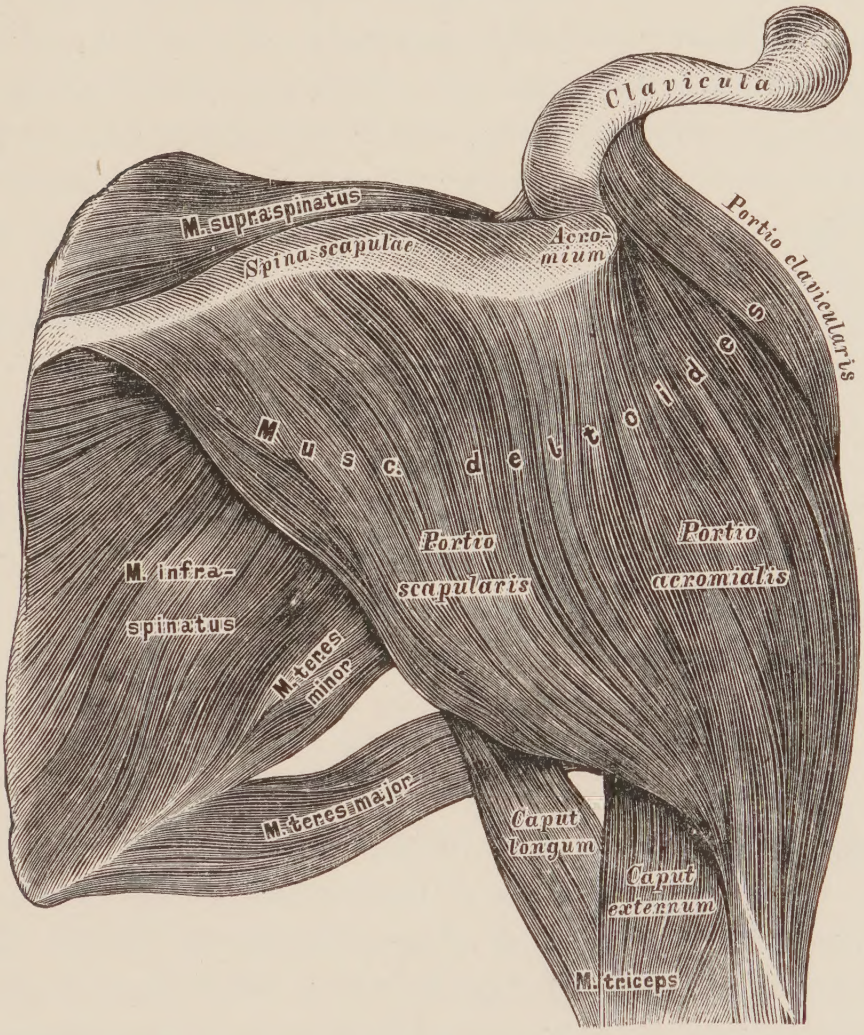
Should there be any question of rheumatic arthritis, or of bone disease, the differential diagnosis must be made with the greatest care, for a mistake, and the consequent employment of mechanical means, might be followed by the gravest results.

Though Erb prescribes absolute rest for the treatment of cervico-brachial neuralgia, I feel justified, in view of an extended experience, to recommend mechanical treatment for these cases as confidently as I already have for sciatica. Indeed, if we proceed upon the basis that neuralgia in general is to be cured by stretching the affected nerve, there is no reason why this variety of it should not, *à priori*, be as well adapted to mechanical means as any other.

While treatment must be applied to all the muscles affected, it frequently happens that certain ones, having become paretic or even entirely paralyzed, need special attention. Areas of anæsthesia and hyperæsthesia are common, and vaso-motor and trophic disturbances may also occur. These symptoms as well as the fundamental trouble all disappear together as treatment progresses. Regarding the form of treatment, it must, of course, always be carefully chosen as adapted to the site of the pain and to the nature of the motor disturbances. In some cases the muscles chiefly involved are those which arise from the occiput and the spinous processes of the cervical, dorsal, and lumbar vertebræ, and are inserted into the scapula—namely, the trapezius, the latissimus dorsi, the rhomboideus major and minor, and the levator scapulæ—in other words, the rotators, adductors and elevators of the scapula and the retractors of the arm. In other cases it will

be the muscles connecting the scapula with the humerus,—the deltoid, supraspinatus, infraspinatus, teres minor and major, subscapularis and coraco-brachialis, these being the elevators, external and internal rotators of the arm. Again, it will be found that the muscles connecting the shoulder with the forearm are most affected, as the biceps, brachialis anticus,

Fig. 38.



and triceps—*i. e.*, the flexors, extensors, and external and internal rotators.

In a few cases all these various groups will be found to be about equally affected.

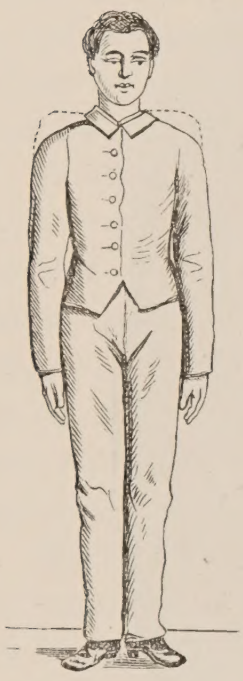
Let us assume we have to treat such a case, the neuralgia being on the left side.

After first performing the required movements upon the patient, he is ordered to imitate them himself, and while doing so, we test the affected muscles with regard to the degree of their

loss of function, and the general sensibility of the parts involved. As in sciatica, treatment is begun with active and passive motions, mechanical manipulations following.

First Day of Treatment.—Passive shoulder-lifting, performed as follows: The physician standing in front of the patient, grasps with his right hand the patient's elbow,—the forearm being flexed at a right angle—and while counter-pressure is made with the left hand upon the shoulder, the arm is suddenly pushed vertically upward; after this has been repeated ten times, the patient is ordered to perform the motion actively, as shown by the dotted lines in Fig. 39.

FIG. 39.



The movements, which will be made simultaneously by the sound shoulder, are only advantageous inasmuch as they serve as a means of comparison by which to judge the disability of the opposite side.

The adductors of the scapula (the rhomboideus major and minor) must be passively and actively exercised, while the patient is engaged in the above. This is performed by the physician, standing behind and pressing both scapulæ as far as possible, inward toward the spinal column. The more forcibly this is done the better. The next thing in order is pressing the affected muscles; this is performed quite gently in the beginning, with the finger tips only, and then more energetically, using the flexed fingers first, and afterward the fist itself. The exaggerated sensibility of the muscles becomes in this way gradually numbed. The manipulations need not occupy more than ten to fifteen minutes. Altogether, the treatment of this form of neuralgia is far less fatiguing, and of much shorter duration than that of sciatica.

Second Day of Treatment.—The patient may declare himself even less able to use his arm than before treatment was begun, and, as in sciatica, the pain will probably be increased during the first few days. The physician, however, need not be disturbed by this, but should proceed to the execution of rotary movements of the scapula, and of internal and external rota-

tion and depression of the arm. For the first of these—scapula rotation—one should stand behind the patient, and seizing the bent arm, near the elbow, push it forcibly upward and outward, repeating the exercise ten times. Rotation of the arm is performed by the physician, standing in front of the patient, grasping the arm extended at the elbows, in both hands and rolling it inward and outward.

The next is generally a fatiguing operation for the physician. It consists in grasping the patient's shoulders, and moving the whole extremity—the scapula participating—first forward and inward, and then backward, and outward. This exercise extends the antagonizing muscles to their maximum, and at the same time stretches their contained nerves.

The mechanical manipulations of yesterday are to be repeated, with the addition of pinching the muscles. In order to be able to grasp the trapezius and supraspinatus, the patient must be directed to lean his head backward and outward toward the affected side. Frequently the outer edge of the latissimus dorsi, also the origins of the teres major and minor, and of the subscapularis, will be found exceedingly sensitive, and will consequently require especial manipulation.

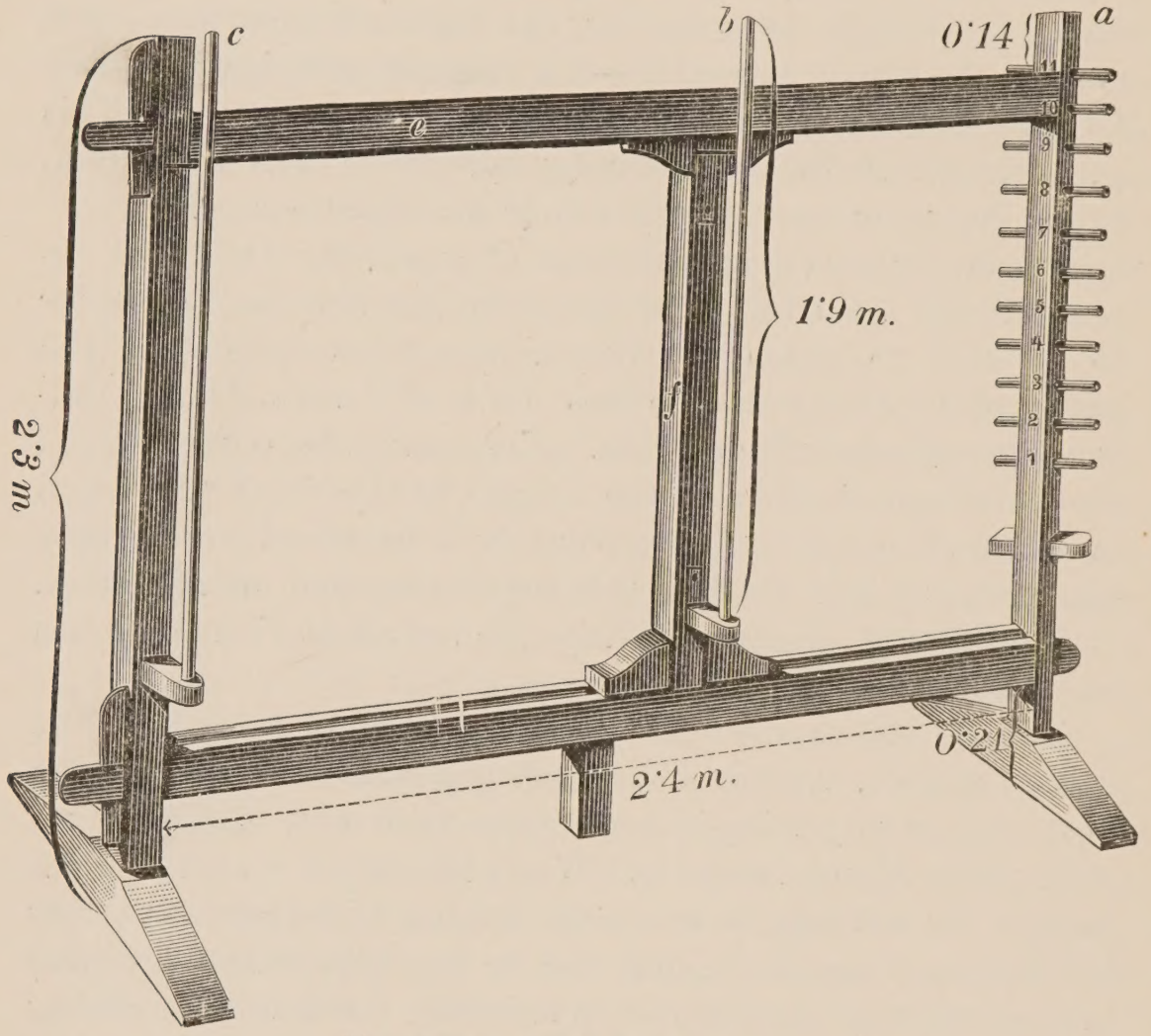
Third Day of Treatment.—Repetition of all previous exercises and manipulations.

As new exercises, we have essays at raising the arm. The deltoid muscle, while it is the most powerful of all the muscles of the upper extremity, is at the same time most difficult to restore to functional integrity. While in sciatica we prepare the patient for walking exercises by making him practise placing his foot upon the horizontal bar, so the apparatus delineated here serves a similar purpose in restoring the motion of raising the arm. It is, besides, useful for a variety of exercises, as we shall see later. For the present we need only consider the portion *a*, which for brevity we will call the "rung-bar." Standing in front of this, the patient raises his arms to the highest rung he is capable of grasping, and rests them there for half a minute, repeating the exercise ten times.

Muscle-hacking should be performed to-day for the first time, care being taken to avoid striking the bones, and to grade the force used according to the thickness of the muscular layers,

using more where they are thick, as over the deltoid, and less where thin, as in the infraspinous fossa. The scapular spine is very sensitive, and hacking over it would be as useless as it might be injurious, for a blow upon it of as much force as those used upon the trapezius and supraspinatus, lying just above, might do considerable damage.

FIG. 40.



Dimensions are given in the metric system.

Anyone at all familiar with anatomy ought to be perfectly competent to perform all these manipulations upon the clothed body (and in women this is absolutely necessary), but the inadvisability of entrusting the treatment to anyone not a physician will be at once apparent. Not that I wish to say that it would be absolutely impossible to a layman, but he should have been previously instructed by a physician in the anatomical relationship of the parts.

Superficial hacking is just as useless as superficial pinching, for both affect only the skin. Those manipulations, on the other hand, which penetrate the deep-lying parts, undoubtedly affect the terminal nerve twigs themselves, whose neurilemma, according to Kühne,[2] becomes continuous with the sarcolemma, the rest of the nerve fibre losing itself within the muscle fibre.

Heat must necessarily also be evolved by these manipulations, and this heat not only endows the molecules of which the muscles are composed with energy, but accomplishes also what may be called internal work—*i. e.*, that work which is performed within the heated muscle itself, and which results in a rearrangement of its molecules.

The muscles to be hacked must, of course, be in a state of relaxation. To this end the physician must put the arm, forearm, and shoulder in positions in which the muscles to be manipulated are neither in a state of contraction, nor, from the action of their antagonizers, in one of forced extension. This is best accomplished by selecting the mean between extreme flexion and extension. In hacking the muscles of the forearm—pronators and flexors as well as supinators and extensors—it is advisable to support the forearm in one's left hand, for if laid upon some firmer basis the internal condyle is apt to be hurt each time the arm is struck. When the elevators and external rotators of the arm (deltoid, supra- and infraspinatus) are to be hacked, the extremity should be allowed to hang loosely from the shoulder. In hacking the adductors, retractors, and attractors of the shoulder (teres major, latissimus dorsi, and coraco-brachialis) the extremity should be slightly adducted, while the forearm, flexed at the elbow, is supported in the left hand. Though it is impossible to hack the subscapularis on account of its position, yet as the origins of those fibres which arise along the outer and inner border of the scapula are frequently the seat of intense pain, they should be thoroughly pressed and punched with the finger-tips. When the scapula is raised as far as is possible from the trunk there will be no difficulty in getting the fingers in along its inner edge to the distance of one centimetre or more, and in

[1] Hermann, Lehrbuch der Physiologie.

this way, by poking, the same effects are gained as by hacking. In hacking the trapezius and supraspinatus, the spine of the scapula is best avoided by beginning the manipulation at the point furthest removed from the affected shoulder, and keeping the blows always parallel to the spine.

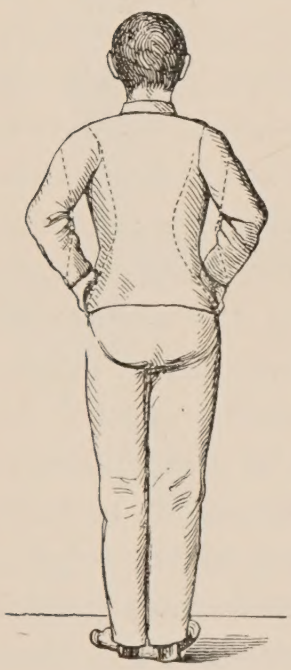
It is immaterial whether the patient stands or sits during the treatment.

Fourth Day of Treatment.—Arm-raising is to be continued until the patient is able to reach the highest rung his own height will allow.

The new passive exercise consists in arm-circling; performed by the physician seizing the affected arm and swinging it round and round so as to describe the largest possible circle, first ten times to the right, then an equal number of times to the left. Repetition of all previous manipulations.

Fifth Day of Treatment.—Each day should be begun with the repetition of all previous exercises, just as in the treatment of sciatica, and the addition of a single new passive and active movement daily is quite sufficient.

FIG. 41.



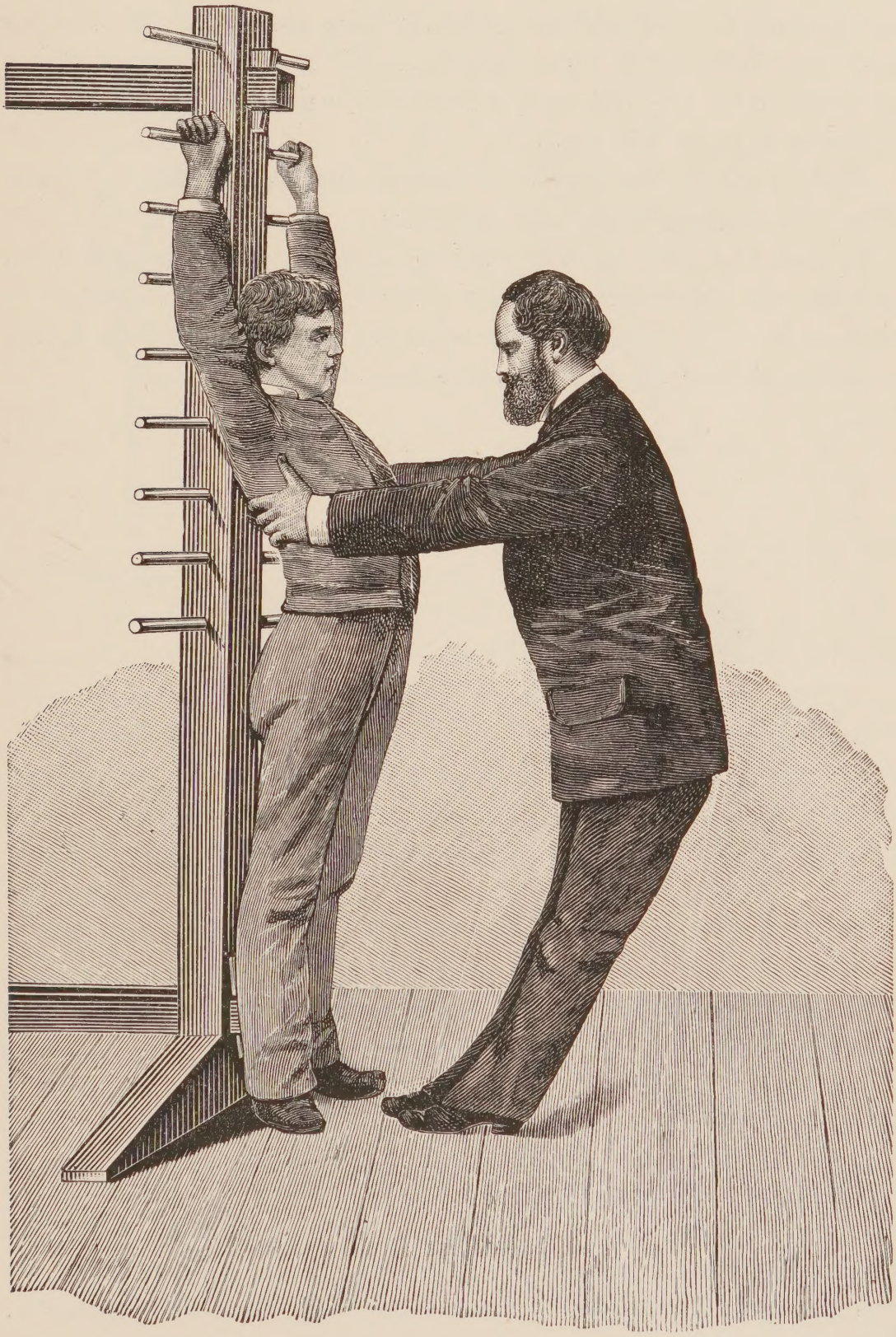
New exercise: Arm-raising sideways first ten times passively, then ten times actively—the active movement to be done with the aid of the rungs, the patient standing sideways to these and beginning at first with a low one, and gradually going higher and higher.

Sixth Day of Treatment.—Drawing the arms downward and backward (involving the infraspinatus, teres minor, and latissimus dorsi). When these movements are performed passively the arms should hang by the side, the elbows being bent, when, in thin persons it may be possible to draw them so far back as to make the elbows touch, but in corpulent or very muscular individuals this will not be possible. This movement puts the two pectorals and the teres major violently upon the stretch and causes considerable pain if they be sensitive, but it is this

very pulling and stretching which, in a few days, deadens sensibility.

Seventh Day of Treatment.—Practically the same exercise as

FIG. 42.



the above, only attained by causing the patient to hold a stick thrust through both elbows, behind his back, for two or three minutes at a time. Sticks of larger diameter should be used each day.

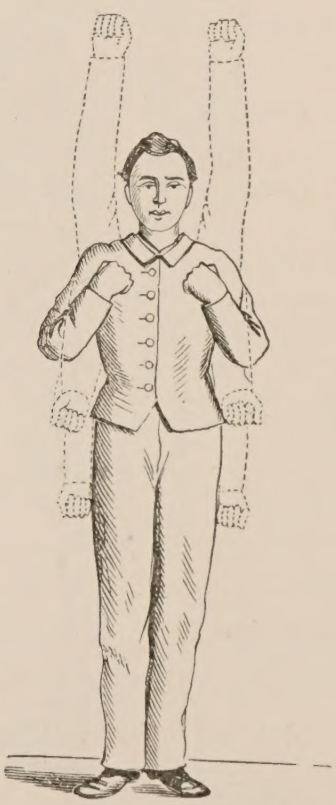
Eighth Day of Treatment.—Intensification of this exercise: by causing the patient to grasp a rung behind him standing with his back toward the rung-bar. This is the more difficult on account of the affected muscles being forced into activity in order to seize the rung.

Ninth Day of Treatment.—Clasping hands behind the back (Fig. 43), both actively and passively.

In men the same results may be obtained by ordering them to take an object from their coat-tail pockets and then to replace it. This act, though apparently simple, proves sometimes so difficult as to require several days to acquire.

FIG. 43.

FIG. 44.



Tenth Day of Treatment.—By this time the affected muscles will have been so strengthened as to admit of vigorous movements of extension being indulged in. These may be performed in five different directions (Figs. 44 to 46); upward,

downward, forward, backward, and outward, and when muscular power has still further increased dumb-bells may be used. These exercises may possibly occupy the time until the fifteenth day of treatment, without the addition of any new

Fig. 45.

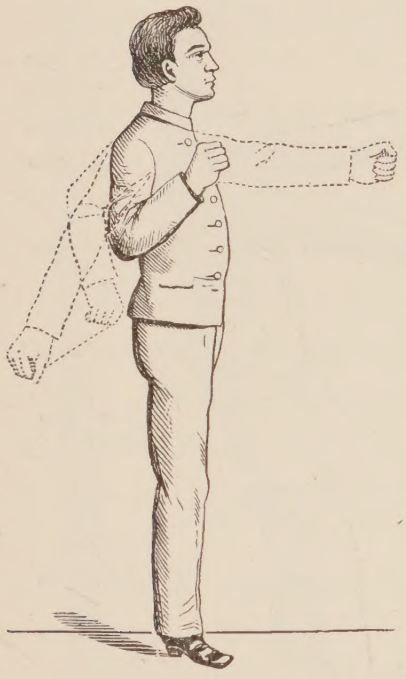
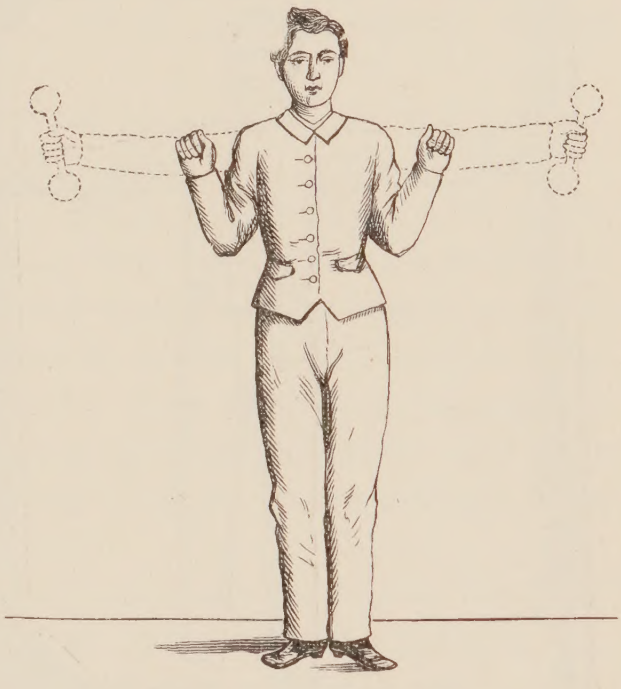


Fig. 46.



form of movement, with the exception of adding dumb-bells to the former motions of arm-raising and arm-circling.

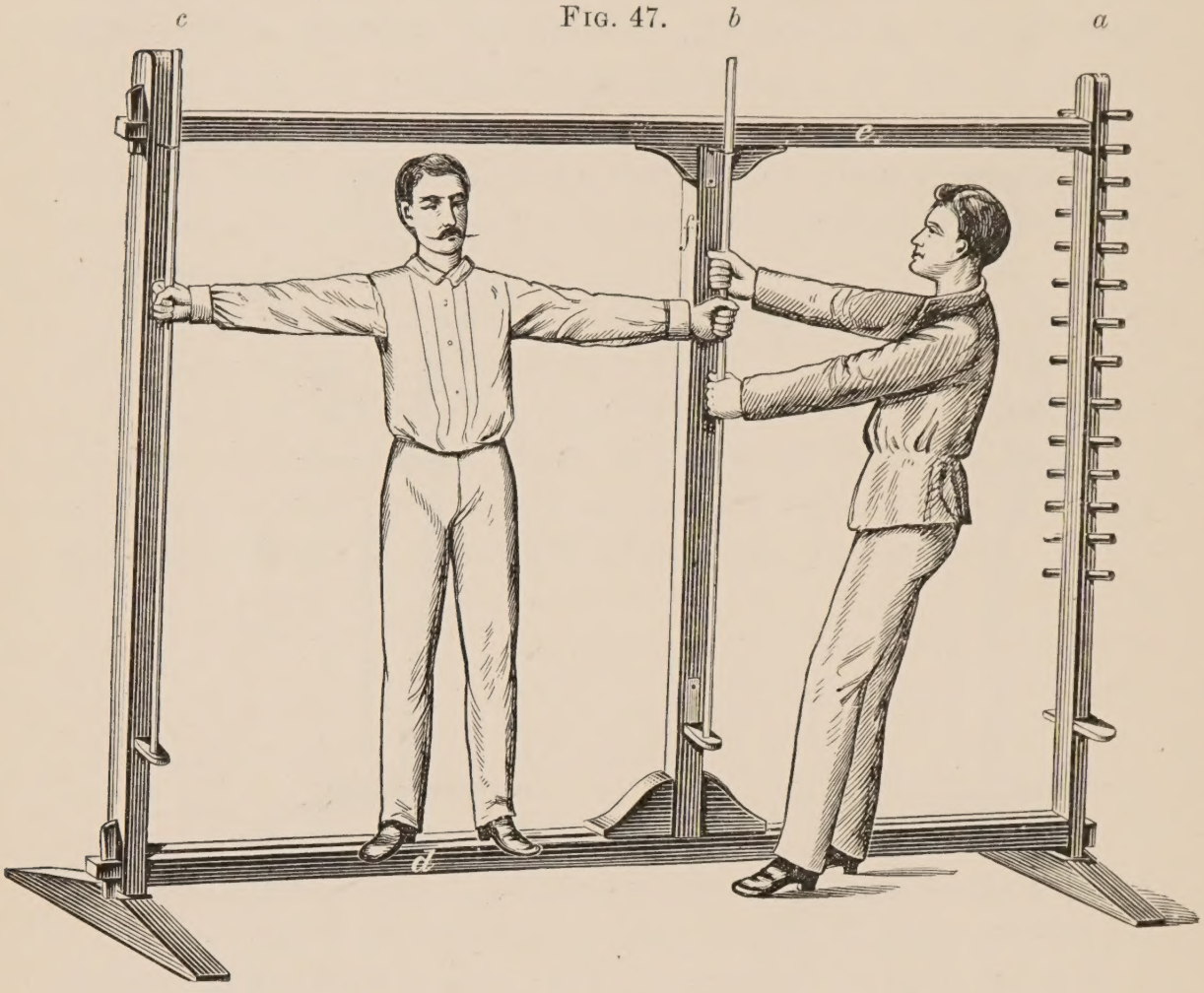
Fifteenth Day of Treatment.—The patient has now arrived at the period when he may be expected not only to perform, unaided, the most difficult of the active exercises required, but to allow also of the more vigorous passive ones being executed upon him.

For the passive exercise the following apparatus is used. The bar *c* is stationery; *b* being attached to the upright *f*, which admits of lateral motion by a tongue at either end, sliding in corresponding grooves of the horizontal cross-pieces *d* and *e*.

The patient, standing on the lower cross-piece, grasps the bars *c* and *b* in either hand, while the physician draws the upright *f* as far as possible from *c*, thus extending the patient's arms to their utmost. The upright *f* is then fixed by means of pins dropped into holes in the cross-pieces (not shown in

the cut).[1] Extension is not to be performed gradually, but with a sudden jerk, and should be repeated ten times.

FIG. 47.



The following half-active, half-passive exercise may be undertaken on the rung-bar *a*, by the patient standing with his back close to it, and grasping a convenient rung over his head. The physician then seizes him by the body just beneath the arms, pulling the trunk forward, while the feet are kept close to the lower end of the bar (Fig. 42). This exercise affects the muscles in a variety of ways. Both pectorals, the deltoid (in part), the biceps, and coraco-brachialis are put to their maximum degree of tension, yet are at the same time forced to actively steady the trunk. The subscapularis, teres major, and latissimus dorsi are likewise stretched, together with all the nerve trunks lying in the axilla.

[1] A simpler form of apparatus may be constructed with ropes, pulleys, and weights, the latter being graded according to the violence it is desired to use.—TRANS.

In this combination form of exercise we see that a typical nerve-stretching operation has been performed,—one which kinesiatricians have been in the habit of practising for years, long before nerve-stretching under anæsthesia was even hinted at.

Fig. 19, taken from the *Cong-Fou*, illustrates a similar form of passive muscular extension, whose action, however, is less intense.

Similar physiological effects are obtained by the old peasant women in Hungary, with their *Csömör*.

Sixteenth Day of Treatment.—When, in the physician's judgment, the muscles of the shoulder have attained sufficient power, climbing exercises on the rungs may be begun, at first, under constant superintendence to guard against accidents by falling. This exercise should be done first with the patient facing the rungs—as in ordinarily ascending a ladder—and later with his back toward them, this being the more difficult form of the two.

Seventeenth, eighteenth, nineteenth, and twentieth days of treatment are to be devoted to practising all the previous exercises.

Twenty-first day of treatment is to be one of entire rest.

Twenty-second Day of Treatment.—Hanging from the rungs by the hands, and climbing from one to the other by them alone, may now be tried, and the ability to perform this, the most severe of all the tests to which the shoulder muscles can be put, is a proof of the patient's entire cure.

General Considerations.

The remarks made upon prognosis, and upon duration of treatment, in considering sciatica are equally applicable here. And I would again say that the plan I have just detailed is but a general one, which may have to be extensively modified to meet various cases. In general, however, it will usually be found best to begin with the simpler and easier exercises, and then proceed to the more complicated and difficult ones.

Cases which have existed for years require a skilled and practised hand, while recent ones, even though the distribution of the neuralgia be quite extensive, may, simply by the aid of

energetic passive and active exercise, and without any apparatus whatever, be cured in the incredible short space of twelve to twenty-four hours.

It sometimes happens that we see cases where, in consequence of exposure to cold, there is a combination of bilateral cervico-brachialgia with bilateral sciatica. The painful points are present and the pains follow the course of the nerve trunks, while at the same time large muscle groups may be exceedingly tender, and suffer interference of function. The question will naturally arise, Are these cases of neuralgia or of muscular rheumatism, or are they combinations of both? It would not, however, be justifiable to wait for the appearance of typical paroxysms of neuralgia, in order to determine the differential diagnosis, because in mechano-therapy we possess a means of entirely curing the patient within twelve to thirty-six hours.

Case IV.—L. H., aged fifty-six, telegraphist in Arco, consulted me in October, 1878, for right cervico-brachial neuralgia of three years' standing. He knew of no reason for the trouble, and I was hardly inclined to look upon his occupation as a cause, although it was the arm and shoulder used in working the key of his instrument which were affected. During the past year he had employed all sorts of remedies, including electricity, but without effect.

On examining him an extensive eruption, covering the neck, chest, and arm, produced by a vesicating ointment prescribed for the relief of his trouble, gave evidence of the last form of treatment used. It had irritated the skin almost to the point of inflammation, but without in the slightest degree relieving the pain.

Four weeks of mechanical treatment, occupying daily not more than ten to fifteen minutes, cured him completely. I have seen him repeatedly since, and he has had no return of his old trouble. Whenever he feels the slightest pain in his arm or shoulder, he goes through the appropriate exercises laid down for him, and is very happy to be able to cure himself by this simple means and so to keep at work.

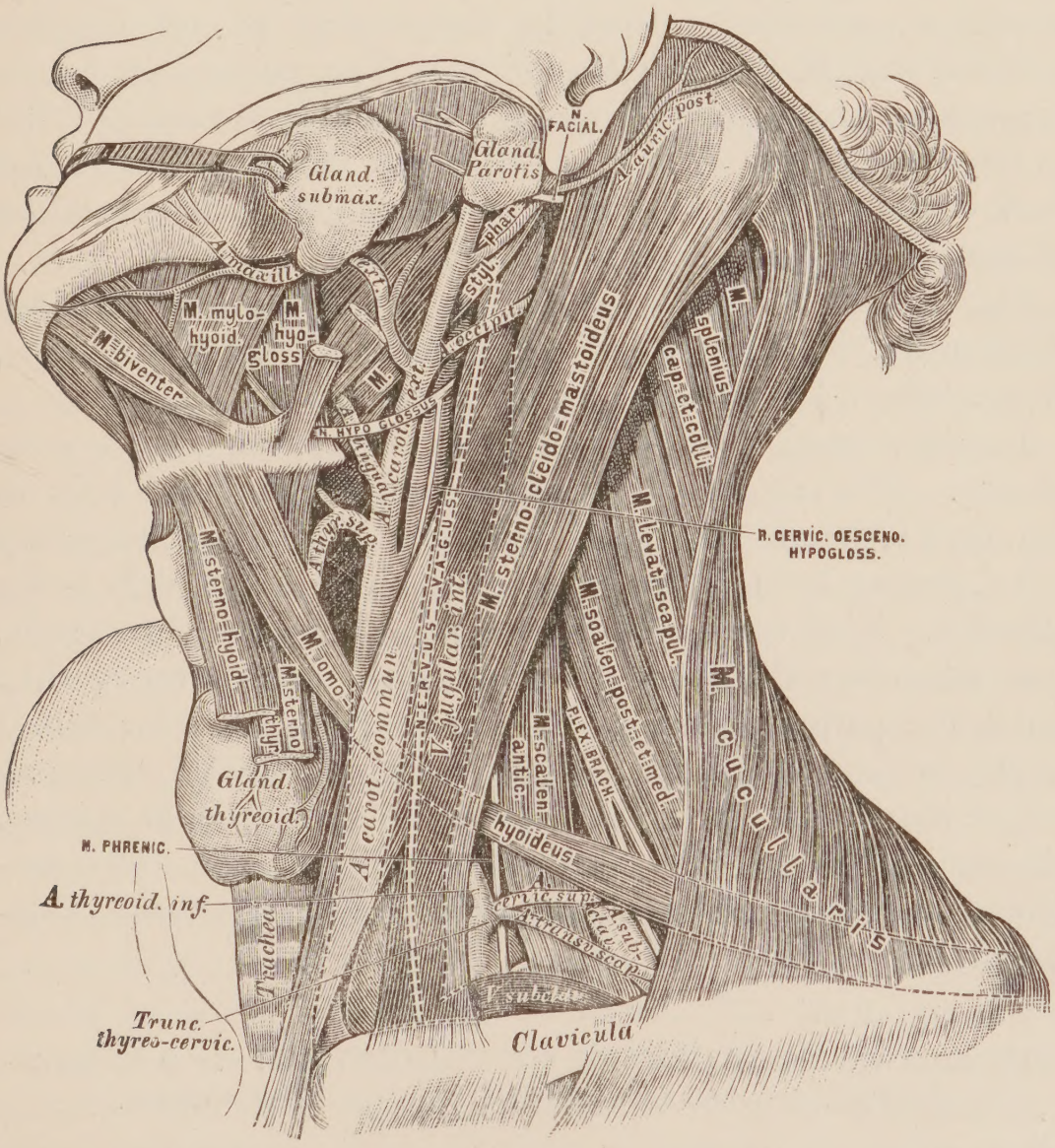
When treatment was first begun he was extremely sensitive, and moaned and groaned with every form of movement used —active, passive, or mechanical. This condition continued

until near the end of his cure. Nevertheless, in spite of it, he all along thankfully acknowledged his satisfaction at the improvement which was visible from day to day. I mention this fact, to show the physician that he must never be deterred by any expressions of pain the patient may indulge in.

TREATMENT OF CERVICO-OCCIPITAL NEURALGIA.

I have never had the opportunity to observe an uncomplicated case of this trouble, but I have often seen it associated

FIG. 48.



with neurasthenia and cephalalgia. The great occipital nerve is the one most frequently involved. The pains radiate toward

the vertex and forehead and are often combined with trigeminal neuralgia. Mechanical manipulation—pressing, kneading, pinching, and mild hacking—of the muscles affected (trapezius, sterno-cleido-mastoid, splenius capitis et colli), proved in all cases efficacious, generally effecting a cure of the occipital neuralgia in from two to four weeks, while the vertical and frontal persisted. Active motion of the head in all directions, including rotation, is a useful auxiliary to the purely mechanical treatment.

Case V.—Mr. E. K. suffered from severe cephalic neurasthenia with occipital and frontal neuralgia, the result of mental overexertion caused by deciphering almost illegible manuscripts till far into the night. The pains had finally become so severe that for months he had been unable either to read or write. Worst of all, were certain pains at the back of the eyeballs, frequently accompanied by the sensation of seeing sparks and lights.

He had gone through a course of hydro-therapy under Winternitz, and had also employed mechanical treatment. Nevertheless, I resolved to try the latter again.

In three weeks the occipital neuralgia disappeared completely. The trigeminal neuralgia, however, and the pain in the vertex, brows, and eyes continued as before, temporary relief, lasting from fifteen minutes to three hours, only being afforded. This temporary alleviation followed so invariably, that whenever the pains returned with more severity than usual, the patient would go in search of me in order that I might operate upon him. Unfortunately, the relief lasted no longer than a few hours. On leaving my institution at Aussee, his occipital neuralgia was cured, but his other troubles continued, even after subsequently visiting two water-cure establishments.

MECHANICAL TREATMENT OF TRIGEMINAL AND INTERCOSTAL NEURALGIAS, AND OF CEPHALALGIA.

While we can always count with certainty upon being able to favorably influence all neuralgias of nerves seated within or between muscles, we find that when we turn to the mechan-

ical treatment of neuralgias of nerves situated between the skin and an underlying bone, our power becomes as limited as it was before almost boundless.

Many of these cases are marked by the peculiarity that alleviation, or even the entire disappearance of the pain, follows manipulation; unfortunately, however, this disappearance lasts for a short time only. In others the gentlest manipulations prove unbearable to the patient, and it seems senseless to persist in so painful a form of treatment when success is more than doubtful? Trigeminal neuralgia, in particular, evinces a most stubborn resistance to mechanical treatment. Of course, such cases as arise from exposure to cold, from carious teeth, or from anæmia, etc., yield to other forms of treatment, or disappear when the cause is removed.

There are two principal reasons why trigeminal neuralgias prove so often unamenable to treatment of any kind, whether mechanical or medicinal.

First. Because a certain class of these cases are traceable either to inherited disposition or dyscrasia, or, in some cases, to organic tissue changes, often of central origin. The diagnosis in these cases is surrounded with difficulties, and it is almost as impossible to recognize the existing anatomical causative changes during life, as it is to influence them by any form of treatment that may be adopted. Autopsies and resections of nerves have shown the existence of the most various lesions, among which may be mentioned thickening of the neurilemma, sclerosis and degeneration of the Gasserian ganglion and the branches connected with it, flattening and atrophy of the ganglion and its branches, calcareous concretions in the perineurium, etc.

Second. We have already seen, in discussing sciatic and cervico-brachial neuralgias, how necessary it is for the cure of long-standing cases, that the mechanical interferences used should be of the most energetic kind. The tissues to which the nerves are distributed must be influenced, even to their very remotest parts, by all the different forms of manipulation at our command. It would seem as though the nerve were forced to participate in the benefits accruing from the increased circulation occurring in the muscle, in whose fibrillæ its own

ultimate fibres become merged—in other words, that the restoration of the nerve is secondary to that of the muscle. The condition most favorable for the application of mechanotherapy, therefore, is absent in these cases, where, instead of substantial groups of muscles, we find only skin, or muscles spread out in thin layers, to operate upon. Then, too, assuming concussion and its consequent molecular changes to be potent factors influencing the cure, we have in the case of the trigeminus insuperable difficulties in the way of applying the necessary hacking, kneading, and pinching to the affected nerve. Stroking and pressing the nerve against its bony support, are the only manipulations possible, hacking—the most powerful means for producing concussion—being totally inapplicable to the head and face, while those portions of the nerve lying within bony canals are entirely withdrawn from the influence of the physician's hand.

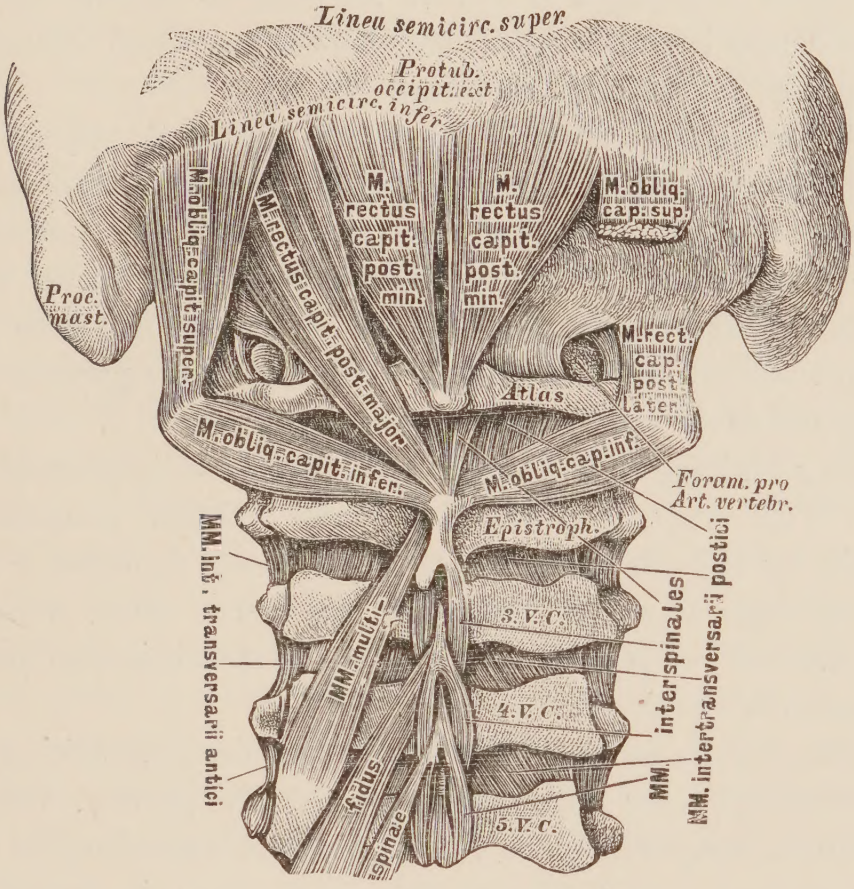
In Case V., already reported, we have a most striking proof that it is in the muscles that the true field of mechanotherapy lies. In this case one and the same cause (mental over-exertion and visual strain from continuous reading) developed cerebral neurasthenia, and occipital and trigeminal neuralgia, the latter of the first and second divisions, producing simultaneously ocular, supraorbital, and supramaxillary pain. The occipital neuralgia soon yielded to mechanical treatment, for all the muscles attached to the superior curved line (splenius capitis et colli, biventer cervicis, and complexus) as well as to the inferior curved line (rectus capitis posticus major and minor, and obliquus capitis superior) could be influenced by kneading and hacking, even down to their very remotest portions, while the frontal nerve from its lying under the orbital roof, was entirely inaccessible to treatment.

The supraorbital nerve, emerging from the supraorbital notch and spreading over the forehead as far back as the vertex, only admits of stroking, for the skin lies so close to the bones that it is impossible to seize the nerve between the fingers. The same conditions obtain for the second division of the trigeminus, with its temporal and infraorbital branches.

Care must be exercised in manipulating the parts of the

skull covered only by skin. The manipulations should be limited to a slow, uniform, stroking pressure, continued in certain directions and executed with the tips of the first, second, and third fingers, or with the thumb. Rotatory, vibra-

FIG. 49.



tory movements are also applicable, especially over particularly sensitive parts, as at the point of exit of the supraorbital nerve.

On the hairy scalp a mild form of beating, performed by drumming with the tips of the fingers, is often of use.

The direction in which the manipulations are pursued is for many patients quite immaterial, while others feel more comfortable if the motions are executed from above downward, stroking in the opposite direction causing discomfort, or even distinctly increasing the pain. Many patients are so greatly relieved by a daily course of rubbing and stroking that one is often misled into the belief of having effected a permanent cure. In others again, the relief does not last longer than

perhaps a few hours, while there are still others who are positively made worse by any form of mechanical treatment whatever.

MECHANICAL TREATMENT OF INTERCOSTAL NEURALGIA.

Intercostal neuralgia is better adapted to mechano-therapy than the forms just discussed, the nerves involved being more accessible to the physician's hand.

The intercostal nerves lie in the intercostal spaces, below the intercostal arteries and between the internal and external intercostal muscles. About the middle of their course they send off branches which pierce the external intercostal muscle. These branches (the lateral cutaneous) supply the skin of the chest and abdomen, and thus afford favorable opportunity for the application of mechanical treatment.[1]

Pressing and kneading the painful areas will, in most cases, suffice. The six upper nerves, whose lateral branches are underlaid by the ribs and the thick pectoral muscles, allow of more vigorous hacking than the six lower ones, which distribute themselves partly to the rectus abdominis and partly to the latissimus dorsi.

It seems hardly necessary to caution against mistaking intercostal neuralgia for those diseases of the pleura, lungs, or heart, which may simulate it. A careful examination of the thoracic organs should always determine the diagnosis. Mistaking it for muscular rheumatism, on the other hand, will be followed by no harm whatever; for, as we have seen, there is no better treatment for both the acute and chronic forms of this trouble than the mechanical.

Case VI.—Dr. G., of Aussee, suffered for several weeks from an annoying pain in the left hypochondrium, increased by motion and respiration. There being a slight rise of temperature every evening, and the region between the kidney and rib becoming somewhat tense, giving to the finger the impression of a solid body lying beneath, it at first occurred to me that my colleague might be suffering either from an

[1] Probably nothing is so rapidly efficacious in the treatment of intercostal or lumbar neuralgias as the application of the Paquelin cautery.—Trans.

exudation into the pleura, or perhaps even from some new growth in this region. As this trouble rendered the pursuit of his vocation more and more laborious, his wife, who was much concerned about him, asked me to see him.

His case was, in truth, somewhat obscure and puzzling. Pleurisy I was able to exclude. Careful examination revealed a very painful spot between the sixth and seventh ribs on the axillary line—mere pressure with the finger causing him to cry aloud—the pains radiating toward the hypochondrium. Each inspiration was accomplished by a sticking sensation in the side.

As physical examination definitely excluded any pulmonary or pleural disease, I felt justified, in view of similar observations, in making a diagnosis of intercostal neuralgia.

I began treatment at once. I had him lie on his side and then manipulated the painful area by pressing, kneading, and hacking it. This caused so much pain that it was only with great difficulty that I was able to complete my labors, for my colleague made a most lively resistance. When, however, I had finished, he found he had been much relieved, for the sticking pain on deep respiration had almost entirely gone.

The next day I repeated the treatment, which sufficed to cure him completely. The sensitiveness disappeared and along with it the fever. Since then he has had no return of the trouble.

MECHANICAL TREATMENT OF CEPHALALGIA.

It becomes necessary, in view of the manifold causes of habitual headache (which often lasts with occasional interruption for years) to accurately formulate those conditions of its existence under which we may expect some reasonable amount of success from the application of mechanical treatment.

Of course, no physician would think of using this treatment where headache was the result of fever, of indigestion, of cerebral tumor, or of periostitis of the cranial bones. Neither could we ever look for success where there was a question of syphilis, of disease of the cerebral substance, of chronic plumbism, or of alcoholism.

On the other hand, when headache is the result of anæmia, hysteria, or neurasthenia, mechano-therapy is of the greatest service. And the same is true when it arises from sexual excesses and onanism, or accompanies hemorrhoids, uterine and ovarian disease, or chronic gastritis. In this class of cases gymnastics often effect a cure when all other means have failed. But of all varieties of cephalalgia, that arising from "catching cold" is most amenable to treatment.

For the headache of hysteria, onanism, and neurasthenia, treatment must not be merely local, but the whole body should be subjected to massage in the form of stroking, kneading, and gentle hacking. Passive and active exercise of all the great muscle groups must be undertaken as well, in order to obtain the beneficial results which were fully explained in the chapter on the physiological effects of health gymnastics.

Constant occupation has a most salutary effect on this class of patients, and the combination of a cold water cure with the movement cure serves materially to hasten the end in view. It is difficult, however, to accomplish much as long as the patients remain within the influence of the family circle. They need the constant supervision of a physician who will lift them out of the old ruts in which their minds have been travelling, and change their whole spirit and mode of life. There can be nothing better for these individuals than the life in a hygienic establishment. The bustle of the place and the stimulus of being thrown together with a number of strangers, together with the regular mode of living, and the discipline to which they are forced to submit, all combine to form a strong curative element. In addition to the regular gymnastics, driving, riding, swimming, rowing, swinging, etc., may all be employed to advantage.

For anæmia, a systematic course of active exercises, as it furthers oxidation, increases the quantity of the blood, stimulates the appetite, promotes assimilation, and increases the arterial pressure and the power of the heart, will prove most efficient. With the return of the blood to its normal composition the headaches will disappear of themselves. These remarks hold good—with somewhat less force—for chronic

gastric catarrhs as well. Here, too, the cold water cure is a useful adjuvant.

For headaches the result of exposure to cold ["rheumatic" of the Germans], pressing and stroking are most applicable, which if maintained always lead to cure.

With regard to the forms of passive and active exercises to be used, all that I have said in my remarks on neurasthenia applies here.

There still remains to be considered, hemicrania (megrim, or "sick headache").

Here, too, stroking has been recommended, but I am sorry to say that my experience with this trouble does not encourage me to persist in treating it by mechanical means, for I have never seen any good result from stroking, and this is the only form of manipulation possible.

Boudet[1] reports having cured a case of megrim in its inception by means of an electric tuning fork tuned to *a* (making 217.6 double vibrations to the second). By means of a short rod having a knob one centimetre in diameter at one end, the vibrations were transmitted to any desired point on the skin.

By applying this knob to sensitive portions—as the supra-orbital region—in healthy persons Boudet was able to produce local analgesia, and occasionally anæsthesia, in eight to twenty minutes. This change of sensation was frequently accompanied by a feeling of dizziness, and followed by a desire to sleep. To R. Vigouroux belongs the credit, however, of being the first to employ the tuning fork in this line of treatment. He mounted the fork upon a sounding-board, and set it in vibration with a fiddle bow. In his experiments he found that in hysterical cases the vibrations produced contractions [it is not stated of what], and banished the existing anæsthesia,—just as the application of various metals, or of a magnet, or of statical electricity do. He states that he was able to arrest a tabetic crisis in a woman, by placing her feet within the box used as a sounding-board.

[1] The treatment of pain by mechanical vibration. Progrès Médical, 1881, No. 5.

MECHANICAL TREATMENT OF MUSCULAR RHEUMATISM.

It is evident, when we investigate the actual nature of the mechanical treatment of the various forms of neuralgia just described, that it consists of nothing more than the thorough manipulation and working of the soft tissues, especially the muscles, in which the affected nerves ramify, so that we may almost lay it down as an axiom: the less soft tissue, the smaller the success.

Accordingly we find that mechano-therapy nowhere meets with more success than in the treatment of muscular rheumatism. Busch[1] says: "I have lately had my attention called particularly to the fact that the pain of rheumatic myalgia is often cured sooner by massage and movement than by rest and local applications." My own experience would lead me to expunge the word "often," and substitute for it "always," for I feel free to maintain that rest actually prolongs the duration of the trouble.

Mechanical treatment, too, is frequently a valuable means for establishing a differential diagnosis, especially in acute cases. Let us assume that in the case of a painful affection of the muscles of a certain region, accompanied by disturbance of their function, we are in doubt regarding the exact nature of the trouble. Mechanical manipulation and passive and active movement are now instituted in spite of the patient's protestations of pain—provided always, of course, no evident contraindications exist. If after a second or third repetition, at intervals of three to six hours, the pains have either disappeared or diminished considerably, and the ability to perform motion greatly increased, we are justified in concluding that the trouble was muscular; but should there, on the other hand, be no change in the amount of pain and disability, even after treatment has been continued for twenty-four to thirty-six hours, it behooves us to seek for some other source of trouble.

Any physician who has busied himself at all with mechanical therapeutics must have seen dozens of cases abundantly

[1] General Orthopædics, Gymnastics and Massage, Ziemssen's Handbuch der Allegemeinen Therapie, vol. ii., Germ. Ed. Leipzig, 1882. Vol. V., Am. Ed. Wm. Wood & Co., New York.

proving the assertion made by Martin in the *Société de Médecine* of Lyons as far back as 1837 (and since confirmed by Bonnet), that recent myalgias, no matter how severe or extensive, whether called lumbago, "stiff-neck," or what not, are capable of being cured by a single application of massage.

A case of Stromeyer's, given in Busch's work already cited, is worth repeating here. A country doctor who was accustomed to visit his patients on horseback, was attacked, after having been for some time in a draughty barn, with the most intense muscular pain in all parts of his body. An old peasant advised him to mount his horse again, as movement and exercise often dispelled these pains. He did so, though it required the help of several men to lift him into the saddle. The first paces of the horse caused most intense suffering, but gradually the pain diminished. A thunder-storm now coming up, the doctor put his horse to the top of his speed, which caused him to arrive home in a great perspiration, but entirely free from his pains.

Mechano-therapists will see nothing very remarkable in this case, for the words, "Arise and walk!" may be confidently said to anyone suffering from a recent neuralgia who will but submit to treatment; the power of motion returning almost invariably after the first application.

Very energetic measures are, however, indispensable. Neither stroking nor rubbing will do. The muscles must be pinched, kneaded, and hacked to obtain benefit. As it would be cruel to begin at once with such vigorous procedures, the gentler measures must be used at first, increasing the force gradually in order to accustom the patient to the pain. But mechanical manipulations alone will not suffice. Passive motion is absolutely necessary, and the immediate adoption of active motion is still more indispensable. This, the most painful of all the forms of treatment used, would undoubtedly alone suffice, but we will find very few patients who can so control their feelings as to resort to its employment at once, before they have become used to the pain by previous manipulation and passive movements.

In Stromeyer's case the force of circumstances replaced the hand of the masseur, and who knows, had the thunder-storm

not forced the doctor to urge his horse as he did, whether he would have arrived home so entirely free from pain.

Regarding the pathogenesis of muscular rheumatism, Busch, in accordance with other authorities, admits that we have no certain knowledge on the matter. And while he expresses himself against the idea of the disease depending upon inflammatory exudation—on account of its disappearing with such suddenness—yet he admits the possibility of its dependence upon partial coagulation of the contractile muscle elements. This view seems, indeed, to find support in the marvellous results obtained through mechanical means, which not only generates heat within the muscle substance, but causes molecular changes to occur there as well.

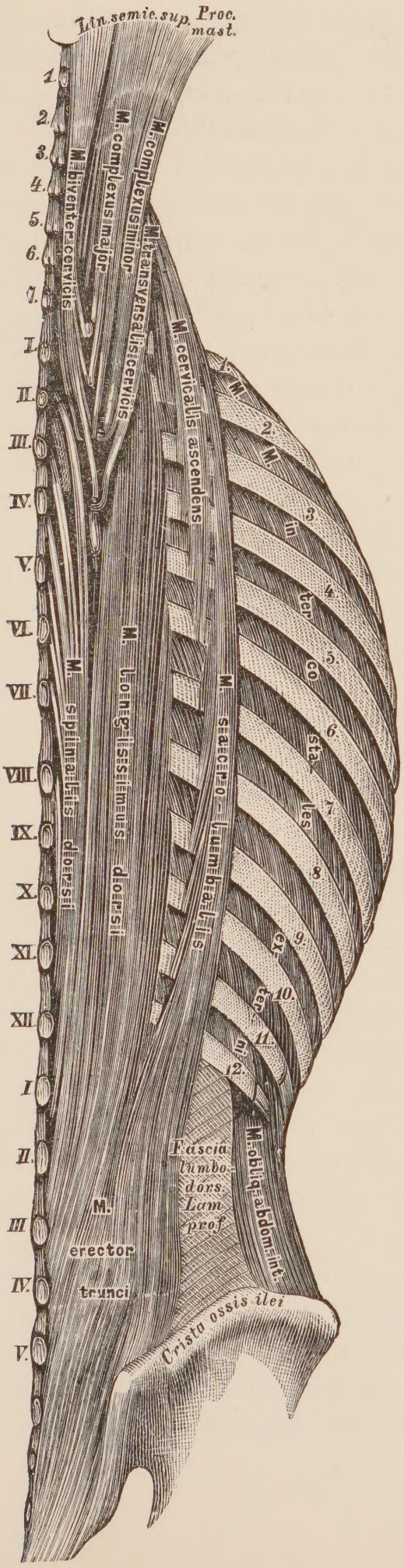
The *modus operandi* of treatment is practically the same for all forms of myalgia—whether it be for lumbago, or "stiff neck," or for those cases where nearly every muscle in the body seems involved.

In treating lumbago, the patient is made to lie upon his belly, and the back is then examined for those painful areas which reveal the location of the muscles affected. Sometimes the points of greatest tenderness will be found at a little distance from the spinal column (sacro-lumbalis muscle), or they may be close to the vertebræ, in the angle between the transverse and spinous processes, occupied by the longissimus dorsi and spinalis dorsi (Fig. 50). The pain may be either superficial, or it may be so deep-seated as to incline one to believe the very deepest muscle layer of all—that of the multifidus spinæ—is involved.

In the beginning gentle stroking only should be employed. When used to this, the patient should be subjected to pressing and kneading, mildly at first, but later with all possible force. And when the pain is deep and the muscles well developed, the knuckles and fists, reinforced by bearing the weight of the body upon them, will have to be brought into play to effect our purpose. Pressing must be carried on both upward and downward along the side of the spinal column. Every few minutes the patient should be allowed a short rest.

The form of pressure known as "rotatory pressure" (see page 58) is often of great assistance in these cases, and should

FIG. 50.


Lin. semic. sup.
Proc. mast.
M. complexus minor
M. complexus major
M. biventer cervicis
M. transversalis cervicis
M. cervicalis ascendens
M. sacro-lumbalis
M. spinalis dorsi
M. long. iss. dorsi
M. obliq. abdom. int.
Fascia lumbo-dors. Lam. prof.
M. erector trunci
Crista ossis ilei
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ter 5
co 6
sta 7
les 8
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ter 10
11
12

be performed with the knuckles and fists. After having gone up and down the painful places several times in this way hacking should be begun, using the edge of the hand, held, of course, parallel to the vertebral column.

A good knowledge of anatomy is nowhere more essential than in the treatment of lumbago. A single blow from a powerful arm, upon the sacro-lumbalis in its upper part, is quite capable of fracturing one or more ribs; hence, in going over these parts we must content ourselves with quite mild procedures, such as rubbing and pressing, or very gentle tapping. Over the muscles lying between the transverse and spinal processes, however, much force may be expended, care being taken to avoid striking the bony prominences of the spine, sacrum, or crista ilii. In cases where the lumbago does not involve many muscles, fifteen minutes to half an hour will be all that is requisite for the various procedures.

Pain on inspiration, which sometimes accompanies lumbago, implies involvement of the serratus posticus inferior, and as this muscle is covered by the sacro-lumbalis it will be reached in executing the manipulations just described.

The mechanical manipulations having been completed, passive motion is next to be undertaken—the patient lying in bed. First, the knees being bent, each thigh necessarily is flexed ten times upon the trunk. Second, the patient, while in the horizontal position, is directed to turn over first ten times toward one side, then ten toward the other. Third, the patient being seated, the physician grasps him by the shoulders and bends the body as far forward as possible.

Active movements are now in order, for, on the completion of the foregoing, the patient will find himself able to stand, which before he was incapable of doing on account of the pain the effort caused.

The following exercises to be performed, the patient standing:

Body-bending—forward, backward (Fig. 51), and sideways (Fig. 54).

Body-circling (Fig. 52) and stick-stepping (Fig. 53).

The attendant may, by coöperating with the patient, help to emphasize each movement as it is made.

After all these exercises have been completed, the patient, who a short time before was practically helpless from pain

FIG. 51.

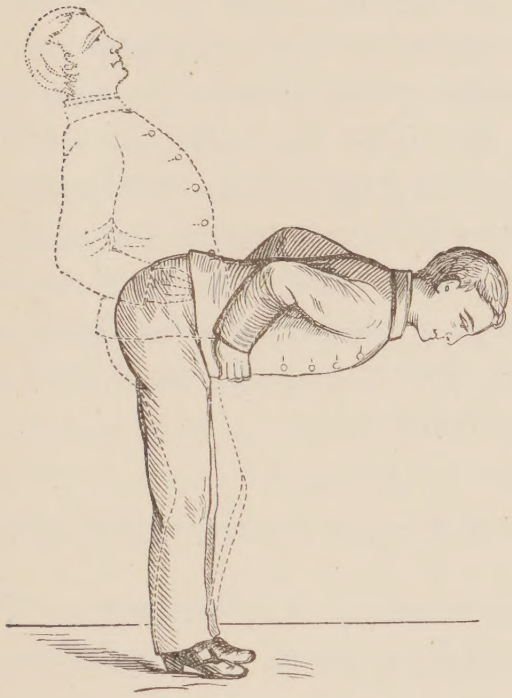
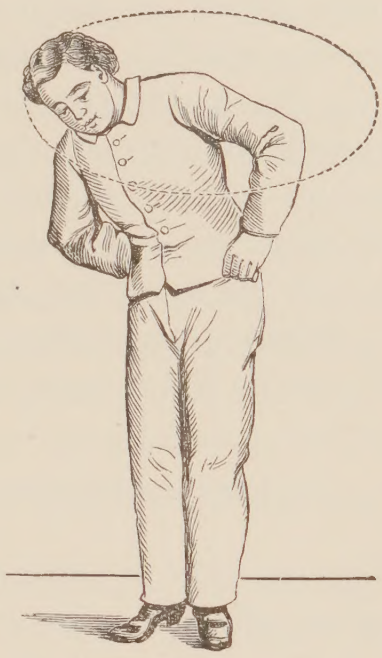


FIG. 52.



and stiffness, will be able to dress himself, to sit down, to bend over,—in short, to pursue the daily business of life. A little

FIG. 53

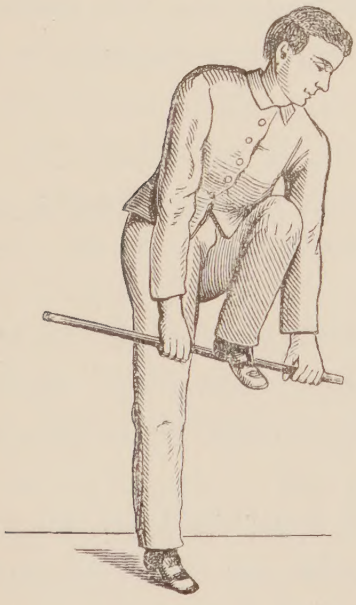


FIG. 54.

pain may still be experienced for some hours, but by the following day this will, as a rule, have disappeared.

It is very important for the physician to have the assurance and boldness necessary to compel persistence in the treatment, in spite of the pain and agony it causes.

In those cases where lumbago results from the rupture of muscle fibres, as occurs for instance from attempts to lift excessive weights, or from a sudden rotatory movement of the trunk, the treatment for the first few days should be that recommended for a sprain. Rubbing, pressing, and kneading must be resorted to, the mobility of the muscles being gradually restored as the extravasation is removed. The severer forms of manipulation, as poking, pinching, and hacking, are not advisable, and active motion should be postponed until the torn muscle fibres have been replaced.

TREATMENT OF TORTICOLLIS RHEUMATICUS (STIFF-NECK).

This trouble is substantially identical with lumbago. The muscles affected—the sterno-cleido-mastoid, and trapezius—are first gently stroked, then successively pressed, kneaded, and mildly hacked. Then follow movements of the head—backward, forward and to either side (each ten times), and finally rotation, performed first passively, and then by the patient himself, the doctor helping a little, perhaps.

All these procedures cause great suffering, but the patient will be repaid by the fact that his trouble will usually be cured at a single sitting.

ON THE APPLICABILITY OF MECHANO-THERAPY DURING THE PRESENCE OF FEVER.

All authors agree in regarding the existence of fever as a contra-indication to mechanical treatment. As soon as this condition appears, treatment should be suspended, and not resumed until it has disappeared.

In those cases of acute myalgia and neuralgia which can be indubitably traced to the effects of cold, we will find, however, that a continuance of the mechanical treatment is one of the surest means of dissipating the accompanying fever. It is, of course, of the greatest importance to be absolutely

certain that the simultaneous appearance of the pains and fever is not a mere precursor of some acute disease.

Not infrequently one meets with cases which seem to be made up of a combination of myalgia and neuralgia, and it is often claimed that these cases soon get well of themselves, without any treatment whatever. The term "soon," however, is very elastic. In place of it mechano-therapy is able to substitute a more precise one, *i. e.*, *twelve to thirty-six hours.* By mechanical treatment we are able to arrest the disturbances of nutrition in their incipiency and, with them, the resulting pain, fever, and loss of muscular function, and also to prevent at the same time the disease from extending or becoming firmly rooted. It is thus that a patient may be preserved from what might otherwise have possibly resulted in months, or even years, of severest pain and disability.

Case VII.—C. S., aged eighteen, domestic, was sitting, in December, 1882, in the hot tap-room of a tavern, near a door that was constantly being opened and shut, so that every few moments she was exposed to a draught of cold air from without. The following morning she had a temperature of 39.5° C. [103.1° F.], with a pulse of 132, and well-developed bilateral cervico-brachial neuralgia. There were *puncta dolorosa* in the supraspinous fossa of the scapula, on the acromion process, and internal condyle. Over the whole area of distribution of the cervical and brachial plexuses the skin was so extremely sensitive that even the gentlest touch caused her to cry out. The distribution of both sciatics, as far down as the popliteal spaces, was affected in the same way, the points of exit of the nerves, as well as the origins of the gluteal muscles, and the back of each thigh, being especially tender. In addition there was bilateral torticollis.

In spite of the presence of fever, mechanical treatment was at once begun. By proceeding very gently in the beginning, I accustomed the patient (who cried and complained constantly) to the unavoidable pain. I then gradually increased the force, using pressure, kneading and hacking, and followed these with the employment of passive motion, allowing a short pause every three or four minutes, the whole

being continued about half an hour. This was in the morning—the patient being unable to leave her bed—and at noon and in the evening I repeated the manipulations for ten minutes each time.

The next morning temperature and pulse both were normal, and the hyperæsthesia reduced at least one-third. Treatment was repeated and the patient forced to get up and dress, though she declared herself unable to do either on account of loss of power. In truth, she was scarcely able to get down stairs, and the muscles of the shoulder and arm too seemed nearly powerless. Nevertheless, toward midday she expressed herself as being better able to move her limbs so that no further mechanical manipulation seemed called for. She now improved steadily, for with every hour she busied herself more and more with her work, and had more frequent occasion to go up and down stairs. The hyperæsthesia also diminished. By the third day it had disappeared entirely from the buttocks and thighs, but lingered, however, until the fifth day over the supraspinous fossa, the deltoid, and internal condyle. Still, we can claim that within twenty-four hours she was able to be at work again.

Chronic and so-called "wandering" myalgias are treated on the same general principles as the acute.

MECHANICAL TREATMENT OF ANÆSTHESIA AND HYPERÆSTHESIA.

Since these conditions of disturbed function are probaby due to some alteration in the chemical or molecular structure of the nerves, it would seem not unlikely that they might possibly be removed by the molecular changes which mechanical measures necessarily bring about. Practice has proved this hypothesis to be true, no matter what the variety of dysæsthesia; whether tactile, thermic, algesic, or all combined. The excellent effects of stimulating ointments, sinapisms, medicinal baths, electricity, and cold douches upon anæsthesia are well known; how much more efficient, therefore, must not mechanical treatment be!

In both anæsthesia and hyperæsthesia the areas involved

must be pressed, kneaded, pinched, and, finally, mildly hacked. Even when the trouble depends on some central disease, much good may still be obtained, as was shown by a case reported by me elsewhere.[1]

This case, when I first saw it, presented all the more ordinary symptoms of tabes dorsalis. A moderate amount of ataxia, together with lancinating pains, and gastric crises, and very extensive anæsthesia of both buttocks existed. When first taken ill—September, 1879—with sudden paralysis affecting the abducens nerve, the patient had, in consequence of the differences of opinion which arose regarding this unusual form of paralysis, become well known as an "interesting case" among the prominent oculists of Vienna, and, if I mistake not, he is alluded to by N. Weis[2] in his monograph on tabes.

The gluteal anæsthesia became very burdensome to the patient, inasmuch as the tactile and temperature senses were both entirely lost. He could not tell whether he was sitting upon a cold stone, or upon a seat upon which the hot sun had been shining (indeed, cold objects often made the impression of hot ones); similarly he was unable to distinguish between a hard and a cushioned seat.

I well knew that anæsthesias occurring in conjunction with neuralgias, especially those associated with sciatica and limited to certain cutaneous areas on the thighs, were curable by massage. So in spite of the generally recognized dictum, that mechano-therapy is of no avail in tabes, I determined, in view of my experience, to give it at least a trial. I began, therefore —very gently and cautiously at first, of course—by letting the patient lie face downward on the bench, and manipulating him for five minutes daily with hacking, deep pressure, and rubbing of the affected parts with the fist—longitudinally, transversely, and with a circular motion. As very little force was used the patient suffered no pain whatever. In twelve days the anæsthesia (of five months' standing) had entirely disappeared.

[1] Schreiber: Massage in the treatment of the anæsthesia of tabes dorsalis. Wiener med. Presse, 1881, No. 10.

[2] Weiss: On Tabes Dorsalis. Wiener Klinik, 1880, page 172.

The patient, who was a highly intelligent gentleman connected with the University, kept a diary in which he noted the effects of treatment upon himself. The following is a literal transcript:

"*Nov.* 11, 1880. To-day massage of the buttocks was undertaken for the first time.

"15*th*. During the past two or three days I have experienced an unpleasant feeling of tension in the parts massaged, interfering with walking, and especially with going up and down stairs.

"18*th*. The feeling of tension is disappearing, locomotion is easier, and there seems to be a slight increase in muscular power.

"19*th*. The lack of sensibility is disappearing, so that now on sitting down I can feel what I am sitting on, whereas, heretofore, it has always seemed as though something were interposed between me and the object sat upon.

"20*th*. The "dead" feeling in the buttocks is disappearing, and sensibility noticeably increasing. When I sit down now, I am aware of the presence of the seat, and can tell whether it is hard or soft. Formerly I felt nothing at first on seating myself.

"22*d*. The natural sensibility of the parts, which disappeared last June, has returned, so that I can now distinguish the lightest touch, where formerly I scarcely felt the hardest pinching.

"23*d*. To-day, the 'dead' feeling having disappeared entirely, massage, which has been continued for the past twelve days, was stopped."

These are the naked facts, and in spite of all the scepticism which is advanced against new therapeutic measures, I hardly like to assume that chance was the important factor in this case, for I think the future will show that the means I used in this instance will find equally suitable applications followed by equally happy results in other cases of tabes.

The case of the patient Mangeant (case, p. 131) is a striking illustration of how, during the use of mechanical treatment, and indeed, in consequence of it, the anæsthesia accompanying neuralgia may become changed to hyperæsthesia of the severest

kind, and of how this in turn may give way to normal sensibility if treatment be continued long enough.

So far, no demonstrable anatomical lesions have been discovered in the cases of loss of tactile sensibility dependent on spinal disease.[1]

Türck was the first to show that anæsthesia of a mild degree could be removed, simply by the use of friction alone. At the same time he expressed the opinion that the effects following the inunction of various salves and liniments were largely due to the mechanical effects of the incidental rubbing. The cutaneous anæsthesia in the case just described, was undoubtedly combined with considerable loss of the muscular sense, inasmuch as in addition to the absence of perception of touch and temperature, the patient was unable to form any conception regarding the resistance presented by the object he sat upon. Simple rubbing of the skin alone, therefore, would hardly have sufficed to restore the muscular sense; for this, manipulations affecting the muscles in their deepest parts were necessary.

TREATMENT OF ARTHRITIC NEUROSES.

In the group of arthritic neuroses must be included that variety to which Brodie gave the name of hysterical, because four-fifths of the cases he observed occurred in hysterical women belonging to the upper classes. Still, the disease may occasionally be met with in women otherwise healthy, and also in men. Berger[2] is inclined to regard the malady as essentially an arthritic neuralgia. Indeed, all authors, from Brodie down to Esmarch, agree that this disease, involving as it does the capsular and cutaneous nerves of the joint, is to be classed among the hyperæsthesias and neuralgias. Berger has sought to trace a resemblance between this disease and neuralgia proper, and while it is true that in it vaso-motor and motor disturbances are seldom absent, still it is rare for the pains in the joints to radiate along any particular nerve trunk as in typical neuralgia.

[1] Erb, in Ziemssen's Cyclopædia.

[2] Berger on arthritic neuralgia. Berliner klin. Wochenschrift, 1873, Nos. 23 and 24.

It has happened that for the relief of unbearable arthritic pain, amputation of the corresponding limb has been resorted to. Yet the subsequent examination of the affected joint showed the complete absence of any anatomical changes whatever, thus demonstrating beyond dispute that joints, like muscles and viscera, may be the seat of such severe neuralgia as to lead to the belief that serious inflammatory process must exist.

The knee and hip are the joints oftenest involved, and women are more frequently affected than men. It is a condition generally dependent on a neurotic tendency, either congenital or acquired, and is very frequently associated with chlorosis, anæmia, menstrual disturbances, and various hysterical manifestations. Rosenthal reports its occurring together with prolonged masturbation. It has also been known to follow seemingly slight injuries. Esmarch mentions as causes, falls while dancing and skating, or from a horse, and contusion of the knee with subsequent bloody effusion into the joint. In some cases it has been known to follow acute general diseases.

Billroth[1] distinguishes four varieties of arthritic neurosis:

1. Those following comparatively slight injuries.

2. Those which remain with some slight effusion after the cure of a spontaneously originating inflammation.

3. Those which have been preceded by neither inflammation nor injury, and which yet on walking cause great pain, (especially in the popliteal space).

4. Those cases in which the pain, at first only simulated (as in hysterical or hypochondriacal cases), becomes finally such a fancied reality and so dreaded, that the use of the limb is finally abandoned.

All of these cases may be complicated by the occurrence of contractures and cramps, the latter being sometimes epileptiform in character.

Billroth grants that possible benefit may be derived from massage applied in the first and second categories, but doubts its efficacy in the third and fourth groups, where he says

[1] Billroth: Zur Discussion über einige Zeit. und Tagesfragen. Wiener med. Wochenschrift, 1875, No. 45.

psychological, rather than surgical, acumen is required to determine whether pain is actually present or not.

He also discusses the likelihood of local anæmia of the bone being the cause of pain. We know—he says—that cerebral anæmia causes headache, that anæmia of the fingers occurring when the hand is "asleep" or has been held in cold water, causes a tingling, and that sudden thrombosis [embolism] of the larger arteries gives rise to intense pain in all the parts lying below the obstruction. Why may we not assume the occurrence therefore, in individuals whose arterial calibre is small (as in chlorotic, anæmic, and hysterical persons), of local circulatory disturbances, and among these, of local ischæmia of certain bones?

In accordance with this theory, Billroth explains the success of massage in these cases as due to the increased circulation which it produces in the part. He at the same time attributes much importance to the influence of the hearty coöperation on the part of the patient, and to the impression made upon his or her mind by the novelty of the treatment, and by the personal influence which the masseur exercises. Nevertheless, in concluding his interesting elucidation of the subject, he awards every credit to mechano-therapy, dwelling on the favorable results observed by him during its use at his clinic —results which in many cases far surpassed his expectations.

This was in 1875. At that time his convictions were unsettled by the conflict existing between the observation of his own undoubted successes, and his well-founded scepticism on the authenticity of the miraculous cures which were being constantly reported. Latterly his views seem to have changed, for he has since himself performed nerve-stretching by the bloodless method in several cases of neuralgia.[1]

An interesting report by Mosetig[2] on the cure of a case of torticollis by stretching the spinal accessory nerve, and the numerous accounts by others of the success attending nerve-stretching, all combine in justifying the assumption that certain forms of neuralgia (more especially the idiopathic) are the result of molecular changes occurring in the nerve elements

[1] Billroth: A case of nerve-stretching. Allegem. Wiener med. Zeitung, 1881, No. 48.

[2] Mosetig von Moorhof: Wiener med. Presse, 1881, No. 27.

themselves, and that some fresh change, such as is initiated by the operation of stretching and other forms of vibration, has the power of restoring the nerve to its normal condition.

The mere fact of nerve-stretching having proved unsuccessful in tabes would not in the least militate against the beneficial results of molecular change when applied to neuralgia, for in the former disease definite anatomical lesions have occurred in the posterior columns, while in the latter no structural alterations whatever have so far been discovered in the nerve-trunks.[1] Besides, the difference existing between the sudden stretching of a nerve trunk, and the vibration produced in the end-plates of its many thousands of terminal branches, such as mechano-therapy effects, must necessarily be very great, and this difference of application is no doubt followed by equally varying results. For while in sudden stretching, the desired end is sought to be obtained at once, mechanical treatment seeks to attain the same result by the summation of many small successive influences.

The joints are readily amenable to mechanical treatment. Cartilages and synovial membranes can be rubbed against one another—at first quite gently, afterward with more force—while the soft tissues around the joint are capable of being manipulated in various ways. By these means vibrations are no doubt produced in the nerves, but the exact effect these have in stimulating circulation it is hard to say. Still, one cannot help being impressed with the idea that the beneficial effects are due very largely to vibration and to the consequent molecular changes, for it is a well known fact that neuralgias of the trigeminus, a nerve which, on account of its being spread out over a bony substructure, offers very little chance for manipulation and consequent vibration, are the most difficult of all to cure.

For the really successful treatment of these cases a large amount of moral influence must be added to the mechanical treatment. Each patient must become the subject of a special psychological study for the physician. At first gentle manipulations of all kinds may be employed, increasing the force with

[1] The author evidently has overlooked those neuralgias which are the result of inflammatory changes occurring in the connective tissue forming the peri- and epi-neurium.—TRANS.

which they are executed as the case progresses. Then passive motions (flexion, extension, and rotation) should cautiously be tried, and these, too, gradually augmented. Next active motion of the corresponding sound joint should be tried, and the patient narrowly watched, when he will soon be observed to unconsciously perform the correlated movements with the ailing limb. He may then be directed to execute the same movements with the latter alone. Finally, exercises first without, then with apparatus are to be employed.

I know of several patients entirely cured by these means, who for a long time had no use whatever of the affected joint. Personally, I have treated but one case successfully. This was of a lady, thirty-five years old, belonging to the richer class, who had been unable to walk for two years on account of pain in the right knee, though at no time had there been any signs of inflammation. The patient had never borne children, was well nourished, and gave no evidences of being inclined to hysteria.

Continuous treatment lasting four months permanently removed both the pain and the disability.

TREATMENT OF PALSIES.

In treating palsies we must, of course, necessarily exclude all those forms the removal of whose anatomical cause is a recognized impossibility. In fact, *paresis*, and not paralysis, is the only form at all amenable to mechanical treatment, though not necessarily more so to this agent than to electricity or hydrotherapy. Within the past few years many cases have been treated with all three simultaneously, where any one alone would not have sufficed. Though why in some cases one form of treatment should be more successful than another has as yet remained undetermined.

In applying mechano-therapy to these cases it will be found useful to employ the same procedures already recommended under neuralgia, except that they should be more gently executed. In consequence of treatment, the affected muscles become more thoroughly permeated with blood, while the

severer manipulations, like pinching, hacking, etc., produce reflex stimulation of the motor tracts.

Passive as well as active motion—no matter how imperfectly the latter may be performed—should be gone through daily. Much patience and perseverance will be required, for progress is but too often so exceedingly slow as to be all but inappreciable, except after the lapse of weeks. Some cases which seem to remain stationary for a long time, suddenly begin to improve and then progress with marvellous rapidity.

It is advisable for the physician to superintend the active exercises personally at least once a day. It often encourages a patient to note the doctor taking enough interest in his case to see that the directions are carefully followed, where otherwise he might become disheartened by the slow progress he seems to himself to be making. In hysterical cases, the physician's personal attention is particularly desirable.

In performing active motion it is always well to set the patient a definite task on some of the apparatus. If he is ordered, for instance, to raise his arm as high as a certain peg, or to place his foot upon a certain rung, the effect produced will be entirely different than if he had merely received general orders to execute movements of raising the limbs. In the former instance the brain, according to Du Bois-Reymond, is also forced to participate.

The mode of action of mechanical interferences is analogous to that by which Erb[1] explains the action of electricity upon paralysis.

This distinguished neurologist holds that an electric, or any other powerful stimulus applied to a motor tract, is capable of overcoming those pathological resistances which exist in the pathway of the stimulus, and of thus forcing, as it were, a channel for the conduction of motor impulses to the muscles. The obstruction which volition alone was unable to overcome having been removed by force, the impulses of the will are now free to travel along their wonted paths again, and, as a consequence, motility, though perhaps incomplete, returns. This is the reason why, after the application of a powerful

[1] Erb : Diseases of the Nervous System. Ziemssen's Cyclopædia.

electric current, a certain degree of voluntary motion has been observed to return, often quite suddenly. It seems not improbable, therefore, that the continued application of a mechanical stimulus would finally result in a permanent removal of the obstruction existing to volitional impulse, and so lead to cure.

Erb, it is true, does not lay much stress on the value of mechano-therapy in the treatment of paralysis, recommending it only as a means of perhaps hastening a cure already begun, but this misapprehension is no doubt based upon a lack of appreciation of the powerful effects exercised by mechanical procedures—effects certainly equal to, and, indeed, in many instances, far more efficient than those produced by the faradic current.

The value of the Swedish methods is nowhere more strikingly illustrated than in the treatment of palsies. Ordinarily, when active motion has been prescribed, all attempts to give particular exercise to the paretic muscles are rendered nugatory by the simultaneous action of the antagonizers, which, from their physiological integrity, easily overpower the weaker muscles. It will, therefore, be the task of the physician to present such resistances as will successfully eliminate this antagonization and allow the paretic muscles to contract. This end can be accomplished most readily by means of various mechanical apparatus, at the same time the patient's convenience will be better suited, inasmuch as he can go through his exercises alone, without waiting for assistance from the physician. Besides, in an apparatus the weights will form at all times a definite measure of the gain in muscle power which is going on. It will, however, be found better on the whole to treat this class of patients, firstly, in hydropathic or gymnasial establishments, for only a few can go to the expense of buying costly apparatus; secondly, medical supervision is highly desirable; and, lastly, because hydrotherapy is a most useful adjunct to treatment.

MECHANICAL TREATMENT OF OPIUM, MORPHINE, AND CHLOROFORM POISONING.

Mechano-therapy finds one of its most practical applications in the treatment of narcotic poisoning, whether resulting from prolonged misuse of this class of drugs or from unusual sensitiveness to relatively small doses.

Erb is of opinion that narcotics—whose chief force is expended upon the centres of consciousness and volition—act, most probably, by being conveyed in the blood to the nervous and muscular systems, and there causing either acute disturbances of nutrition, or chronic disease of different divisions of the apparatus which determines active—*i. e.*, willed—motion, which finally results in abolition of function.

For the treatment of the accidental administration of an overdose of opium, morphine, or chloroform we possess no readier or more efficient means than the mechanical, whether applied in the shape of beating, pinching, or hacking of the muscles over the whole body, or of repeated strokes on the palms and soles. We read of cases where these procedures have been kept up for many minutes and even for hours, resulting, in the end, in the resuscitation of the poisoned individual.

For a due appreciation of these facts, we must bear well in mind the differences existing between poisoning by chloroform, and by carbonic acid gas, or by morphine.

It is a generally recognized fact that the lethal action of chloroform is far more sudden than that of either of the other two. Long experience has shown that if, in chloroform poisoning, the evidences of returning life do not reappear within the first few minutes after the paralytic symptoms have shown themselves, death, in spite of every effort, is the almost inevitable result. In asphyxiation by carbonic acid gas, on the other hand, unconsciousness may last for a long time, while the often death-like coma of morphine intoxication is even still less dangerous. I have had frequent occasion to observe cases of the latter: the pulse may be barely perceptible, the sounds of the heart scarcely audible, and the respiratory movements so reduced that scarcely any thoracic motion is dis-

cernible, while, at the same time, the extremities grow cold and the expression becomes fixed. Still, in spite of all these apparent evidences of speedy dissolution, there need be no great cause of apprehension, since the action of the heart and lungs is not suspended but only reduced to its very minimum. Nevertheless, the alarm of the patient's family, as well as the deep concern of his physician, are not entirely uncalled for—for cases enough exist to show that there is often no awakening from this profound sopor.

For these accidents there is no more efficacious treatment than the mechanical. It is far superior to the application of sinapisms, ammonia, or electricity. M. R. Levi[1] has collected a mass of interesting material, from his own and others' experience, bearing upon this subject. He cites the case of a young woman, aged twenty, suffering from nervous asthma, who, after taking between 0.02 and 0.03 (one-third to one-half grain) of morphine subcutaneously, showed evidences of the most profound poisoning. When seen, respiration was very irregular and superficial, the pulse was thread-like, the surface had begun to grow cold, and there was profound coma. The administration of drugs was out of the question. An electric battery was at once sent for, but pending its arrival Levi had the palms and soles well whipped with rods. Four persons took part in this, and they plied their task till the perspiration rolled from their foreheads!

In a short time the patient moved one leg, then the respiration deepened, and presently she sat up in bed and began to cry. The flagellation being now suspended, she at once relapsed into her former state, and, if left to herself, would no doubt have died. But the switching was immediately begun again, and continued, with occasional short pauses, for more than an hour. Before resorting to this bastinado, Levi had tried the application of strong ammonia water to the palms and soles. This did not even produce redness or warmth, nor did any ecchymoses follow the beating, although so long continued and so well applied.

The following similar case is reported by Graves in his

[1] M. R. Levi: Della flagellazione, Venice, 1877.

clinical lectures for the year 1823. Dr. Barrett, of Middletown, Conn., was called to see a Mr. Wright Harris, who had taken one and a half ounces of laudanum with suicidal intent. Emetics and friction having failed, he procured a few supple willow switches which he used so successfully and vigorously upon Mr. Harris's palms and soles that this gentleman presently awoke and began to remonstrate at the treatment he was receiving. As, however, he very soon after sunk again into a state of profound lethargy, it was necessary to apply another unmerciful switching to arouse him—a procedure which it subsequently became necessary to repeat frequently, as coma reappeared whenever it was suspended for a while. This treatment was continued, with occasional interruptions, for eight hours, several persons relieving one another in order that there should be no relaxation in the severity of the application. At the end of this time Mr. Harris was declared out of danger. No ecchymoses appeared subsequently on either palms or soles.

Dr. Barrett is of opinion that only a pain as severe as that produced by the switching was capable of arousing the nervous system, and thus preventing a total cessation of all bodily function—in other words, of keeping Mr. Harris alive.

Dr. Bullar, of Southampton, claims to have saved every case in which there was suspension of respiration following chloroform narcosis, by himself and his assistants vigorously slapping the patient's body with the palms of their hands. This was kept up until pulse and respiration were again perceptible, which sometimes did not happen until as much as ten minutes had elapsed. In many cases the application proved to have been so vigorous that the lower extremities particularly were covered with ecchymoses. Bullar insists that no time should be lost in trying electricity and other useless measures, but that the mechanical treatment should be at once resorted to with full confidence as to its efficacy. He states that in several of his cases the action of the heart and lungs had ceased completely and beyond a doubt, but that by mechanical treatment life was once more recalled.

The foregoing, as well as the following cases I have excerpted from Levi's work just cited, because they seemed to me to have a practical value for every physician, as all of us may

be placed in the position where a knowledge of these valuable facts may enable us to save a human life.

De Angelo, Levi's assistant physician at the Ospizio Marino for scrofulous children on the Lido near Venice, took, in order to test its effects upon himself, a tablespoonful of some febrifuge which probably contained false Angostura bark, a drug containing much strychnine. In half an hour tremor, nausea, and vomiting set in, together with confusion of intellect, imperfect hearing and articulation, and difficulty in standing. These symptoms were followed by delirium, a well-marked epileptic convulsion with complete loss of consciousness, and such marked suspension of the functions of the heart and lungs that death seemed imminent.

Friction, strong sinapisms, douching with cold water, as well as the external and subcutaneous application of strong ammonia water, having all been tried in vain, his two colleagues in attendance and their two assistants provided themselves with switches from a convenient tree and rapidly stripping these of their leaves, applied them most vigorously to the palms and soles. After diligently persevering for a quarter of an hour, the legs were slightly moved for the first time, then, gradually, superficial respiratory movements appeared together with intermittent beats of the heart. On the flagellation being continued for fifteen or twenty minutes more, respiration and pulsation became entirely normal again, warmth returned to the surface, and finally consciousness was restored.

TREATMENT OF CHLORAL POISONING.

A case of chloral poisoning occurring in the Cook County Hospital is reported in the *Chicago Medical Journal and Examiner* for November, 1876, by Dr. J. W. H. Meyer. Unfortunately, the dose taken is not stated and many details are omitted. Meyer merely states that flagellation was instituted several hours after the drug had been taken, and that, as consciousness returned, electricity and dousing with cold water were substituted in order to spare the patient's skin as far as possible.

Levi gives preference to the use of rods or switches applied

to the palms and soles rather than to the whole body, and only when these are not easily obtainable does he recommend the use of the hand instead.

It is possible that by this time this well-known Venetian physician, who undoubtedly has kept himself informed on the progress of mechano-therapy, may have changed his former opinions, and would be inclined to favor manipulation of the entire body, especially of the larger muscle groups. This, by promoting circulation, forces more blood into the muscles, where, according to Fick, the effete matters whose retention would react injuriously upon the system are eliminated.

It seems not impossible that the narcotic in the blood may also in this way be oxidized and rendered innocuous.

GROUP II. MECHANO-THERAPY OF SPRAINS, SYNOVITIS AND TENDO-VAGINITIS, GLANDULAR ENLARGEMENTS, CHRONIC METRITIS, AND HEMORRHAGIC ENDOMETRITIS.

In treating the diseases classified under Group I. our object was to effect a cure by reëstablishing disturbed circulation, by rectifying malnutrition in muscles and nerves, and by inducing molecular changes by means of vibrations. In Group II. we shall seek to reach our aim by the removal of exudations and extravasations through the process of forcing them into the lymph channels after previous crushing and trituration.

Sprains.

The older of the French works (I allude, however, to none written before 1863) are very full of the treatment of sprains—in fact, many of them contain little else. Philippeaux describes, even to the minutest detail, the methods of treatment in vogue up to his time (1870), with Lebatard, Girard, Milet de Tours, and Magne, and all these are again repeated in the work of Weiss.

Each of these physicians had his own particular methods, and each accomplished the common end in view. The chief differences between them consisted in one set seeking to attain a cure quickly by energetic but necessarily painful means,

while the other, contented with slower progress, used gentler and consequently less painful measures—just as in treating neuralgias and myalgias we may, according to choice, proceed either rapidly or slowly.

Any one, however, who is desirous of curing a sprain by mechanical treatment in a few days—instead of by rest and antiphlogistics in two to four weeks as formerly—must not only be well posted upon the mechanics of the part to be treated, but must have a thorough knowledge of the capabilities and limitations of his art as well, and nowhere can he gain a better idea of the whole subject than by reading Busch's article in Ziemssen's *Handbook of General Therapeutics*.[1]

A sprain is defined by Busch as the forced excursion of a joint beyond its normal limit of movement. In consequence, the articular surfaces on the side toward which movement takes place are pressed together, and a point of contact is formed which serves as the fulcrum for the lever which forces apart the opposite portions of the articular surfaces. In consequence of the gap caused by this separation, a vacuum tends to form within the joint, but this is prevented by the soft periarticular tissues being forced in by atmospheric pressure. At the same time the tendons and ligaments are violently extended and may be even slightly torn. The moment the force is removed, the articular surfaces instantly approximate again, occasionally including folds of synovial membrane between them, or displacing the interarticular cartilages when these exist. The pain caused by a sprain is the natural result of these mechanical disturbances. It occasionally happens that the sheaths of the tendons are ruptured, and the tendons themselves sprung out of place and over some bony prominence.

Having thus laid down the exact nature of a sprain, Busch divides, from pathologico-anatomical considerations, the object to be achieved by mechanical means into two divisions.

1. Restoration to their normal relations of all the component parts of the joint. He cites here the practice of one of the older French surgeons—Ravaton—who, whenever called upon to treat a recent sprain if swelling had not yet taken place,

[1] Vol. V. Smith, Elder & Co., London, and Wm. Wood & Co., New York.

had the joint forcibly put on the stretch by two strong men pulling in opposite directions, while he clasped his hands about it, locking his fingers, and making firm pressure on every side in order to force into place any bones that might have become dislocated. Then, after replacing such tendons as had slipped from their grooves, he applied a bandage.

This restitution of all the parts to their normal environment is especially important in joints possessed of semilunar cartilages, for they are particularly liable to be displaced by sprains, and to remain caught between the articular ends of the bone —a condition called "internal derangement" by English authors.

2. Removal of the spastic muscular contractions. After a muscle has been put violently upon the stretch it reacts, and

FIG. 55.

a state of tonic spasm ensues, which is not only painful in itself, but doubly so in these cases on account of the squeezing together of the articular surfaces which it causes. This spasm

may, however, be quickly dissipated by gently rubbing the muscle.

In treating a sprain of the foot we begin with gentle centripetal rubbing, using first the finger-tips, then the whole surface of both hands (Fig. 55), commencing at the toes and gradually proceding upward as far as the painful spasm reaches. As the pain diminishes, more and more force may be employed, and when the contraction has so far relaxed as to leave the joint movable, gentle flexion and extension of the foot should be performed. A flannel roller carried above the ankle should then be applied. After the second or third sitting the movements of the ankle-joint will generally be quite free and almost painless. The patient may then be allowed to walk a few steps. Should this not be followed by an increase of pain the amount of exercise can be cautiously increased until full use is reëstablished, watching closely all the time for the first signs of any inflammatory swelling.

Other joints are treated on the same plan. Of course, mechano-therapy is powerless to restore such accidents as rupture of ligaments, or the tearing off of bony prominences, as not infrequently occurs in severer sprains. All that we can do in these cases is to promote absorption of the effused blood by spreading it over a greater area. For restoring the injured parts, time, and the maintenance of a suitable position, by apparatus, are absolutely necessary.

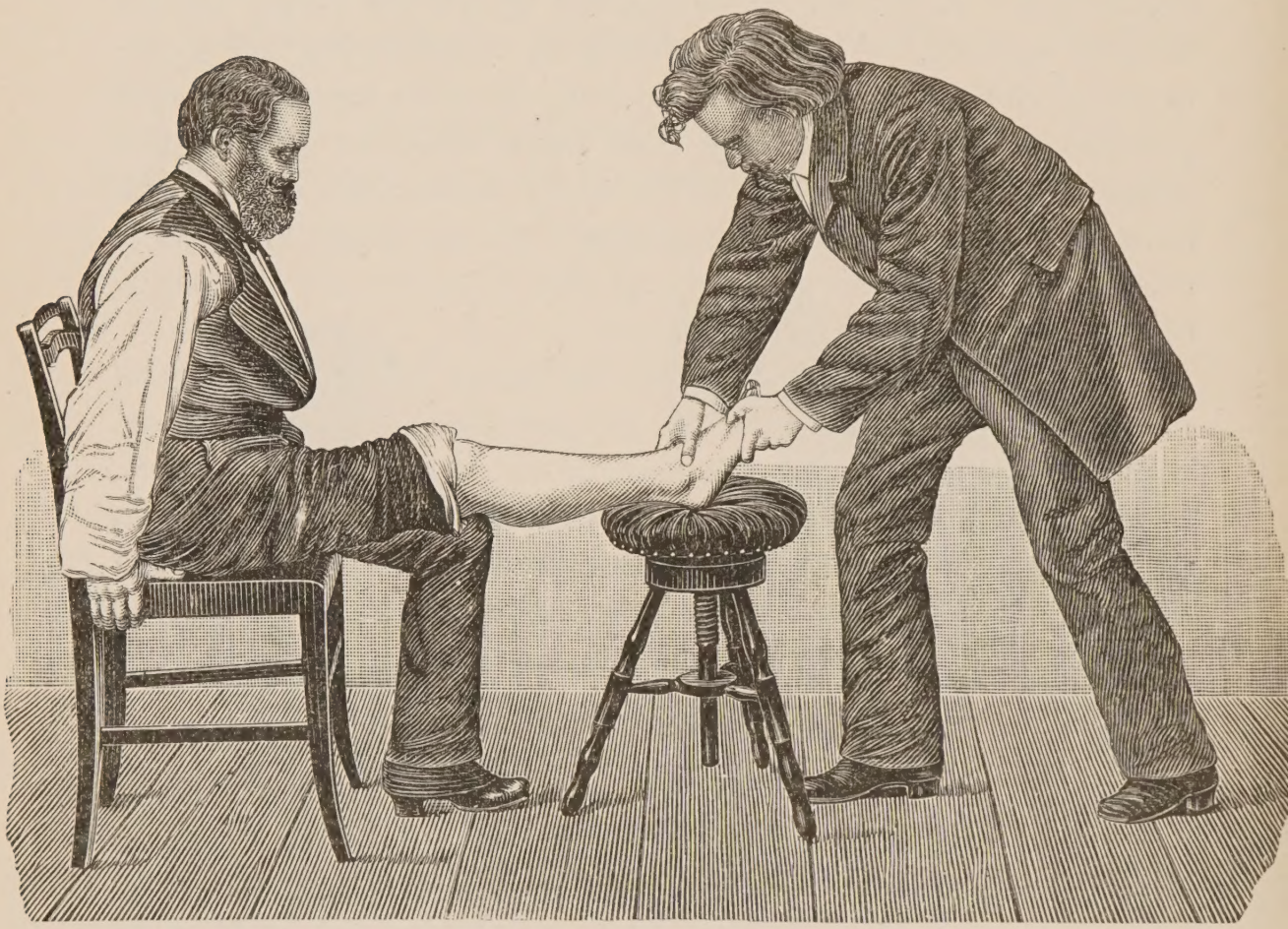
Altogether, it would be a great mistake to treat every sprain by massage or movement, for, when serious complications, like the above, exist, cure will be retarded instead of hastened by this kind of treatment. Indeed, if persisted in, it may lead to chronic arthritis, a result which may well be looked upon as the greatest danger we have to fear from the use of the mechanical treatment of these cases. Used with discretion, however, it undoubtedly leads to a far more rapid restoration of function than when rest alone is employed.

These are the temperately expressed views of an experienced surgeon like Busch, who undoubtedly speaks from experience. As may be seen, they differ from the utterances of some authors, who assure us that every sprain is capable of being cured in a few hours, or at most days.

Usually, manipulation is repeated two to three times daily, it being a good rule to begin manipulating again as soon as the pain recurs.

According to Philippeaux, recent slight sprains are nearly always curable at a single sitting, and even in the severer cases (provided, of course, there is no fracture) four to five sittings suffice to put the patient on his feet again. The sooner treatment is begun the quicker will be the cure.

Fig. 56.



At first sight this seems to be the same as Fig. 55, but it will be noticed there is a difference in the positions of the hands of the operator.

French authors are in the habit of laying down the most minute directions for treatment, even to describing the way each finger of the operator is to be placed, but to my mind, these pages on pages of description are only tiresome and confusing for the beginner, who, if he has any aptitude for the subject at all, will learn far more from such general directions as are laid down by Busch. The same authors assure us that the largest extravasations of blood may be removed in one to

three days, by forcibly compressing with the thumb (*écrasement* or *massage forcé*), where other methods take several weeks (Fig. 56). Rizet[1] recommends massage where there is great swelling about the joints from contusion. It is only by first removing the swelling in this way, he says, that the existence of a fracture can in many cases be determined.

All authorities agree on one thing, and that is that the time consumed in treating a sprain mechanically is far less than by the old method of immobilization and cold applications. Thus, according to the statistics of the military surgeon Mullier, the average number of days required to cure sprains (most of them of the ankle) by immobilization was 25.6, while by massage but 9 days were needed. And Möller,[2] who compiled his statistics from French army records, found results equally favorable to mechano-therapy. Indeed, not only are all specialists agreed upon the superiority of this treatment, but many of the most prominent general practitioners have given it unlimited praise as well. Trousseau and Pidoux say: "C'est une des plus heureuses pratiques, que nos contemporains aieut retrouvées," and German physicians are equally enthusiastic. Hueter says, its results are truly astonishing, and adds: "If, as often happens, the 'natural bone-setters' meet with more success in the treatment of joint troubles than regular practitioners it is simply because the latter are ignorant of the rational means for curing these cases." Cabesse, Wagner, Gassner, Bruberger, and Körner also give it their hearty endorsement.

In treating sprains all manipulation must be directed centripetally, differing in this respect from Group I.—the neuralgias and myalgias—where direction is immaterial.

Treatment of Synovitis, Tendo-vaginitis, and Glandular Enlargements.

The treatment of these affections consists in triturating the exudation, and subsequently removing the liquified mass by forcing it into the lymphatics.

[1] Emploi du massage pour le diagnostic de certaines fractures. Paris, 1866.

[2] Du massage, son actione physiologique et sa valeur thérapeutique, spécialement au point du vue de l'entorse. Journal de Médecine, Brussels, 1877.

All varieties of synovitis are not suited to mechanical treatment, as, for instance, the purulent, or those that threaten to become so. Treatment can be most successfully applied to joints whose synovial capsule is situated near the surface. The manipulations should always be directed centripetally.

The knee is the joint most frequently involved, and should be treated daily for five to ten minutes at a time. Passive movement always facilitates matters, though months are often necessary for a complete cure, the time required depending upon the previous duration of the disease.

Those forms of synovitis which are accompanied by hyperplasia of the tissues, will require the most energetic rubbing and kneading, as well as passive motion (flexion and extension) to remove the new-formed tissue. The treatment of this form, contrary, perhaps, to expectation, is not as painful to the patient as it is in some others.

Serous Tendo-vaginitis; Chronic and Crepitant.

In this trouble we seek to remove the synovial excess, which usually collects slowly and without any inflammatory symptoms, by firm pressure of the thumb.

The crepitant form is distinguished from the simple serous by the fact of the exudation undergoing a coagulative solidification within the sheath; this gives rise to a more or less grating sound when the tendon is moved. The disease frequently results from over-exertion, and is commonly found in piano and violin players. Old cases will often prove incurable, in spite of the most persistent treatment. I recall a case in which the exudation was removed by treatment till not more than one-third of the original mass was left, but this remainder defied all efforts at further removal. It felt to the touch harder in consistency than before, probably because the soft outer envelopes of the grains, of which the mass consisted, had been rubbed off and removed by the mechanical treatment to which they had been subjected, leaving only the hard kernels behind.

Treatment—which consists in transverse and rotatory pressure applied with all the force the thumbs are capable of—is not only very painful to the patient, but at the same time

exceedingly fatiguing to the physician, but any means less vigorous would be entirely useless.

The Report of the Hospital of Wieden, for the year 1877, contains some instructive information bearing on this subject. Two cases of acute tendo-vaginitis of the hand were cured, the first in nine, the other in fifteen days, while a chronic case affecting the tendons of the extensors of the right foot and the peronei, after having lasted two years, was cured in five weeks. Two cases of serous bursitis were also cured by massage, in ten and fifteen days respectively. On the other hand, two other cases of bursitis, treated by antiseptic incision, required twenty-five days.

Treatment of Mastitis and Tonsillitis.

There can be no doubt that the resorption of glandular exudations can be materially hastened by mechanical treatment.

Treatment of mastitis by mechano-therapy was reported by Bergham[1] as early as 1874, and more recently in Prof. Loebisch's *Medicinish-chirurgische Rundschau* for May, 1882, there appeared an article recommending gentle rubbing and kneading of the indurated portions for from five to ten minutes. In quite recent cases, this is said to suffice for the removal of lumps the size of an egg, but in older cases several sittings, as well as more force will be required. Usually some thick yellowish milk flows from the gland during the operation. A case can only be considered cured when the indurated portion has become of the same consistence as the rest of the gland. The younger Niehaus[2] also reports the rapid cure of recent mastitis by kneading.

Tonsillar hypertrophy is treated in the same way. In the tonsils, however, approach is possible from one side only.

Quinart[3] directs that the finger, previously dipped in powdered alum, be pressed against the tonsils (from the inside) at first gently, and then with considerable force. This treatment is followed by the use of an emollient gargle. The whole pro-

[1] Bergham och Helledey: Some remarks on the kneading manipulation. Nord. med. Archiv, vol. 7.

[2] On Massage: an Address, etc. Correspondenzblatt für Schweizer Aerzte, 1878.

[3] Massage des amygdales hypertrophées. Journal de médecine et de chirurgie, 1879.

cedure is so simple that the patient can readily perform it upon himself after a few trials.

In past years I have had frequent occasion to see, in patients frequenting Aussee for the saline baths, the disappearance of glandular enlargements follow a six to ten weeks' course of mechanical treatment, when salt baths and salt pack had been entirely without effect.

Some of these were old cases of hypertrophy of the submaxillary and parotid glands which had existed for years. On the other hand, I have every now and then come across cases where the most persistent and energetic treatment was of no avail.

My own mode of treatment consists in fixing the gland, or glandular mass, with the left hand, and then rubbing and kneading it forcibly with the right, at the same time pressing and squeezing it laterally with the fingers.

A few remarks upon some of the peculiarities of these cases may be of use. Thus, in a certain class of cases I have seen treatment persisted in for six weeks before there was even the beginning of any improvement. In another class, marked diminution of the swelling could be noted after a week, then progress would become very slow, and, finally, cease altogether, an enlargement still remaining against which all further treatment proved powerless.

Experiences like these have consequently led me to be very cautious in venturing upon a prognosis, both as regards ultimate success as well as time required.

Treatment of Chronic Metritis and Parametritis.

Of late years uterine diseases have been subjected to mechanical treatment. Of these, the chronic and hemorrhagic forms of metritis only belong in the present group, while some other diseases of the womb and ovaries will be treated of in Group III., next under discussion.

The first mention of mechano-therapy applied to the uterus is by Cazeau[1] in 1844, who recommended massage for uterine

[1] Traité de l'art d'accouchements. Paris, 1844.

atony during parturition. Norstrom[1] reports successful treatment of chronic metritis, endometritis hemorrhagica, and prolapsus vaginæ by massage. His method consists in first fixing the parts with the first and second fingers introduced into the vagina, and then kneading the uterus through the abdominal walls, with the other. In 1878, Asp[2] called attention to this subject by publishing the results of seventy-two cases treated by him in a health-gymnastic establishment in Helsingfors. These cases embrace chronic metritis, ulcerations, oöphoritis, chronic catarrhal troubles, perimetritis, and displacements of various kinds.

A. Reeves Jackson,[3] of Chicago, gives a detailed account of his methods. He uses massage in the earliest stages of chronic metritis, considering it of no use later, when the muscular tissue has been replaced by proliferated connective tissue. Recent cases, consequently, offer greater chances for success. Treatment should be continued patiently for several months, the sound being introduced from time to time to test whether a diminution in size is taking place. He recommends that in the beginning the kneading should be performed very gently, and not longer than eight to ten minutes, gradually increasing the force as well as the time consumed, until the latter occupies as much as forty minutes. Should pain be complained of only after every third or fourth day of treatment, massage should be continued until the patient becomes accustomed to it. Occasionally it takes some time to overcome the sensitiveness of the abdominal walls, but not until this has been accomplished can massage of the uterus proper be really undertaken.

Jackson uses three different methods:

1. Abdominal massage, which is entirely external.
2. Abdomino-vaginal massage.
3. Abdomino-rectal massage.

Of these, the abdomino-vaginal is the most efficacious. The uterus being grasped simultaneously from within and without,

[1] Traitement des maladies des femmes par le massage. Gaz. hebdom., 1876, No. 3.

[2] Asp: Massage in chronic uterine disease. Virchow and Hirsch, Jahresbericht, 1879.

[3] On massage of the uterus as a means of treating certain forms of enlarged womb. Trans. Am. Gynecolog. Soc., 1880, vol. v.

is firmly kneaded and moved up and down, and back and forth, in every possible direction. The other two methods are only used when this one is rendered impossible by a vagina too narrow or too sensitive to admit two fingers—one finger alone being insufficient. An objection to rectal massage is, that the mucous membrane does not stand the interference well. Abdominal massage is indicated in cases where the fundus projects above the symphysis pubis. It consists in grasping the uterus with both hands through the abdominal walls, and firmly pressing and kneading it, and at the same time moving it about in every direction.

In the three cases which Jackson reports (two of them following abortion) the size of the uterus diminished considerably, while the accompanying symptoms disappeared either entirely or in great part.

The successful treatment of this class of cases is also confirmed by Gussenbauer,[1] and the case of a woman, thirty-four years of age, is reported by Goodell, in which there were retroflexion and incomplete prolapse, causing a train of unpleasant symptoms, all of which disappeared entirely after he had operated upon the lacerated cervix and massaged the uterus.

J. Rosenstein,[2] of San Francisco, reports the removal by massage of an enormous retro-uterine hæmatocele, resulting from the application of a galvanic current, used for the purpose of inducing abortion.

Greulich[3] recommends massage for the removal of exudations remaining from previous perimetritis; only, however, where all other means have failed. The tumor is to be grasped with both hands and carefully manipulated.

Busch condemns all attempts at loosening adhesions, which may remain after peri- and para-metritis, and which often give rise either to sterility, or to various hysterical phenomena. He regards them as fraught with much danger, owing to the liability there is of setting up fresh inflammation.

In Sweden, however, Thure Brandt frequently prescribes massage for this purpose. An assistant introduces two fingers

[1] Observations on Massage: An Address, etc. Prager med. Wochenschrift, 1881, Nos. 1, 2, 3.

[2] Centralblatt für Gynäkologie, 1881, vol. xiii.

[3] On Para- and Peri-metritis. Wiener Klinik, July, 1882.

into the vagina and presses the uterus firmly against the abdominal walls, while a second assistant grasps it with his thumb and two fingers and subjects it to every kind of manipulation calculated to loosen the adhesions.

I have myself repeatedly employed these means in similar cases, and always with success, never having seen inflammation follow, but I took the precaution to begin very gently, and only increased the force when I saw that the treatment was being borne well.

Together with manipulation I generally use a combination of passive and active movements, employing thigh flexion passively while in the horizontal, and actively while in the erect position, also "hewing" [as though splitting a log with

FIG. 57.

FIG. 58.

an ax] (Fig. 57), squatting (Fig. 58), trunk-circling, the backward bend, and turning over in bed. The weights may also be used. (See Fig. 113.)

According to Busch, these exercises tend to loosen existing adhesions; first, through the movements of the abdominal and pelvic viscera which necessarily ensue; and, second, through the good effects of the generally stimulated circula-

tion. Unfortunately, many months of patient application are needed before any marked results can be hoped for.

There is a certain class of cases—of which the following are examples—which may properly be included in the present group, in which the success of treatment depends upon the mechanical removal of some exudation, though the primary disease itself might perhaps be more properly classified under some other heading, or possibly even excluded altogether from the realm of mechano-therapy.

In 1878, Von Winiwarter[1] published two unique cases, which so strikingly illustrate the manifold applicability of mechano-therapy on the one hand, as well as the dependence of its successful application upon correct diagnosis and thorough knowledge of its technique on the other, that it seems worth while to give a sketch of them here.

The first is entitled "neuralgic pain simulating sciatica; tumor in the lumbar region; massage; restoration of the use of the leg."

A man, fifty-eight years of age, was advised to consult Von Winiwarter in regard to massage for a severe pain in the left leg which had resisted treatment for five years, and which for the past two had kept him in bed. The pain, which was of true neuralgic character, radiated from the lower part of the back downward along the outer side of the thigh to the knee, and even as far as the toes, and also toward the coccyx. The paroxysms, which were well marked, lasted two to three minutes and appeared as often as sixty times a day, alternating with a dull, heavy aching of the whole limb. They disappeared when the patient was lying, and were less frequent when sitting, but returned at once upon standing and attempting to walk. He had, consequently, during the past two years gone no further than the distance between his bed and his desk, always requiring the help both of his cane and of a servant.

The motion of a carriage, or a railway coach gave him great discomfort, especially if he was obliged to let the leg hang down. His easiest position was a half reclining one, with the

[1] Two illustrations of the use of massage in chronic disease of internal organs. Wiener med. Blätter, 1879, No. 29.

leg stretched out. The various physicians whom he had consulted pronounced the case to be one of sciatica.

On first examining the patient Von Winiwarter detected nothing abnormal excepting atrophy of the left lower extremity. He was struck, however, with the fact that the point of emergence of the sciatic nerve was not sensitive, but that the pain seemed rather to come from a region higher up. Palpation in the left lumbar region revealed a flat, slightly nodulated, and, on its outer edge, sharply defined tumor reaching as far upward as the last rib. It seemed to be deeply situated beneath the muscles, but owing to the corpulence of the patient its exact relations were hard to establish. It was not painful to palpation except at a certain point, where pressure caused a most sudden and intense pain, and at once brought on a neuralgic paroxysm. When asked to locate the seat of greatest pain, the patient invariably pointed to the thigh and coccygeal region, and never to the tumor. Indeed, neither he nor his family had any idea of the latter's existence. Von Winiwarter made up his mind that this tumor was the cause of all the trouble, but in regard to its nature he was entirely at a loss. Examination showed it to be of a tense, elastic consistency, with a point of doubtful fluctuation in the middle. No boundary could be felt on the side toward the spinal column, from underneath the side of which it seemed to project. The overlying skin was unchanged in color and not adherent to the parts below. Nothing could be ascertained by abdominal palpation, owing, as before remarked, to the patient's corpulence. Nor did the previous history of the case throw any decided light upon its possible nature.

For twenty years the patient had had a mild cystitis, for which, though it gave him no trouble, he went yearly to Carlsbad. Five years before he had had some febrile disorder, the nature of which had not been determined, but which had been accompanied by severe pain in the region of the kidneys, lasting several days. There was no dysuria, but the turbidity of the urine was said to have been somewhat increased for a few days. This illness confined him to bed for several weeks, and during convalescence the present pains began, which continued to increase in severity up to the present time.

On Von Winiwarter's taking the case, an analysis of the urine by Prof. Ludwig, of Vienna, showed the presence of a trace of albumen, together with some pus corpuscles and bladder epithelium. No renal epithelium was found.

In view of all the facts ascertainable, the tumor seemed to Von Winiwarter to stand in close genetic connection with the left kidney. He supposed it to have begun as an inflammation in the perinephritic tissues, resulting in the formation of a mass of exudation, similar to those occurring in the neighborhood of the uterus. This mass—which had begun to soften in the centre—by pressing upon the lumbar plexus was the source of the neuralgia; the pain originating in the lumbar, but radiating to the sacral nerves as well. In this diagnosis Prof. Billroth, who saw the patient a few days later, concurred. Both were agreed as to the advisability of employing massage, not only to reduce the extreme sensibility of the nerves, but to effect, if possible, a decrease in the size of the tumor.

Treatment was begun on January 14, 1878. At first it proved extremely painful, but the fact that decided improvement took place served to buoy up the patient's courage. In a fortnight the painful points along the thigh had disappeared and short walks could be taken without aid. The paroxysms were first reduced to one or two a day, and then, finally, ceased altogether. Exercise of the leg, in Von Winiwarter's presence, by inducing confidence served to dispel the dread of pain, which still clung to the patient whenever he attempted to use the limb. Finally, after sixty-four days of treatment, the patient went back to his home cured. The tumor had been reduced to a small, firm remnant, in which no fluctuation was apparent. Hard pressure upon it still caused pain, but no paroxysm resulted. The patient was able to walk for several hours at a time every day, and could use the leg in every way like a normal one. A marked change, too, occurred in his psychic condition; his expression, which before had been profoundly melancholic, now vividly reflected the beneficial effects the cure had had upon his mind.

There are many highly interesting features in connection with this case. It shows, to begin with, how much caution must be exercised before making an unqualified diagnosis of

"sciatica." The absence of the painful point at the exit of the sciatic nerve was enough to make Von Winiwarter suspect that in this case, certainly, he had not to deal with ordinary sciatica, and had the patient been treated by the methods laid down by me under the head of Sciatica, without at the same time seeking to remove the tumor, no good effects would probably have been obtained. If, on the other hand, the tumor had been of a firm and dense structure, massage would have been useless, and the knife would then have been the only rational means of interference.

The various forms of congestive œdemas are also properly to be ranked in the present category.

The use of pressure by bandaging, so long in vogue, is in reality but a form of treatment based on mechanical principles.

Œdema of the lower extremities, caused by abdominal growths, can nearly always be greatly relieved, if not entirely removed, by persistent manipulation (kneading and rubbing centripetally) performed once or twice a day for some time.

The manipulation—which is very easily learned—should be performed with the patient lying or seated opposite the operator, with his limbs, previously oiled, raised upon a support. At first the rubbing should be carried on quite gently, later the force can be gradually increased. It is well to begin at the toes, rubbing upward over the ankle and up the leg, either with one hand alone, or with both hands placed side by side, clasping the limb. Or, the hand being half clenched, the inner side of the first and second joints of the first finger may be used. The rubbing and pressing should be maintained equably and forcibly for from five to fifteen minutes.

In manipulating œdematous abdominal walls, the motions should be made from above and outward, in a direction downward and inward toward the inguinal region, for the lymphatics of the anterior and lateral portions of the skin of the abdomen empty into the plexus of lymph nodes lying within the pelvis and upon the internal iliac muscle. This plexus empties its contents into the superior lumbar nodes, and these again into the thoracic duct.

Every year I see œdemas arising from the pressure of

uterine fibroids, greatly benefited by massage. They are all so alike that any detailed description of each is unnecessary.

The second of Von Winiwarter's cases, already alluded to, is of such unusual occurrence, however, and has such a direct bearing upon this class of cases, that I give it here.

A woman, seventy-nine years of age, had suffered so greatly from the dropsy resulting from the pressure of a multilocular ovarian cyst, that she had to be tapped eight times within five months. Upon massage of the legs being undertaken by Von Winiwarter, the œdema diminished, while, at the same time, diuresis increased. Subsequent massage of the abdomen for nine months resulted in a diminution in the size of the tumor—a diminution which, though at first progressive, finally became stationary. No fresh œdema appeared. Von Winiwarter being at this period prevented from giving his personal attention to the case, the massage was undertaken by an inexperienced hand, with the result that the old state of affairs soon returned, only to disappear again, however, when Von Winiwarter resumed the case—a proof of what has so often been observed, namely, that the success of treatment depends very largely on the individual skill and knowledge of the operator.

In his report of the case, Von Winiwarter adds a justification for the employment of this form of treatment. He instances, in the first place, the beneficial results obtained by Chrobak in cases of congestive œdemas arising from the pressure of uterine fibroids; and, in the second, his own observations upon the rapid absorption by the ovarian cyst wall of various medicaments, like potassium iodide, for example, which a short time after injection into the cyst reappears in the saliva and tears. Reasoning from the experience he had had in removing fluid from œdematous limbs, where its absorption by the blood had caused secondarily increased diuresis, which finally led to the entire elimination of the fluid from the body, he assumed that the cyst fluid, which has a low specific gravity, could be likewise removed by mechanical means. While not attempting to decide the question as to whether the fluid is absorbed by the lymph or by the bloodvessels, he combats the idea that resorption is not due to the immediate manipulation of the cyst itself, but rather to the stimulation of the circulation as a

whole, which, by leading to increased diuresis, necessarily involves an increased absorption of the cyst fluid. If this latter explanation were the correct one, he maintains, mechanical treatment would be equivalent in its effects to that by diuresis and purgation, yet it is a universally acknowledged fact, that the ovarian fluid remains unaltered in quantity, even after the most vigorous and prolonged use of diuretics and cathartics.

His mode of treatment of this class of cases has been criticised as being connected with a great many difficulties, and being, at the best, but palliative. But to this he replies by showing that in this case massage had been of more effect than repeated tapping, that it had not only prolonged life, but had made it as bearable as it possibly could be made without resorting to radical operation.

Von Winiwarter, therefore, regards massage as indicated in all cases of ovarian cyst, where from any cause operating is impracticable. He insists, however, on its thorough and vigorous execution, for a considerable time, if any good results are to be expected. He goes so far as to recommend it, without fear of injurious results, for any deep-lying abdominal tumor the nature of which is obscure, even though a malignant growth or suppurative process be suspected, as well as for all cases of ascites where it is deemed inadvisable to stimulate the kidneys by diuretics.

He lays great stress, however, on the fact that for a proper appreciation of the results it is important that treatment should be carried out by the attending physician himself, or, at any rate, by a *physician* properly instructed. No nurse should be allowed to treat a patient according to some studied routine, for the result will only be torture to the patient and discredit to the whole system.

I cannot forbear repeating here a remark of Von Winiwarter's which reflects so well the prejudice which in 1878 still existed in Vienna in regard to massage. He said: "I am quite ready to shoulder the responsibility for the mildly comical aspect which appears to lie in the proposition of treating abdominal affections by fisticuffs!"

Treatment of Stiffness of Joints and Tendons.

It not infrequently happens that, after arthritis, thickening of the periarthritic structures, or even adhesion of the articular surfaces themselves may occur, leading to very considerable disability of motion. Only by mechanical means can we then hope to break up the existing adhesions, to smooth the roughened articular cartilages, and to restore to the ligaments their former suppleness and elasticity.

All the mechanical interferences used—pressing, rubbing, kneading, as well as the passive exercises—must be performed with the greatest care, since it is quite possible to initiate fresh inflammatory action by injudicious treatment. Within the first two weeks precaution is doubly necessary, as some individuals are quite unable to stand the mechanical procedures. Increased temperature of the joint, fever, severe and continuous pain may all occur; symptoms indicating that an obstinate persistence in treatment would certainly lead to severe inflammation. In these cases a postponement is absolutely required.

The successful treatment of these cases affords one of the most difficult problems of the mechano-therapist, for it requires untiring perseverance and patience as well as nice judgment and all the fruits gained by experience to tide the patient over the necessary pain which for months he may be called upon to bear. And, withal, the guaranty of perfect restoration of the affected joint must never be given, for the degree of use which may possibly be regained can never be predicted in advance, because there are cases (fortunately exceptional) where, in spite of the best of treatment, no success is attained. As a rule, the longer the existing condition has lasted, the longer will treatment be necessary, and the more uncertain will be its result, yet one every now and then meets even quite recent cases to which it is impossible to restore any but a slight degree of motion. Success depends not so much on the duration of the adhesions as upon their extent and firmness.

Treatment should only be begun when all signs of inflammation have entirely disappeared. Some prefer to perform

massage with the part immersed in hot water or under a hot water or steam douche.[1] I have been accustomed to use both a warm saline water (such as occurs at Aussee) as well as cold water in performing massage, reserving, for the sake of comparison, certain cases which I treated without either, but my observations are not yet numerous enough for me to formulate an opinion on the combined influences of hydro- or balneotherapy and mechano-therapy.

When many joints are involved, as may be the case in chronic rheumatism, the execution of all the different procedures may occupy an hour or more, and as they are necessarily painful, it is as well to confine one's self to the manipulation of a single part at each sitting.

The passive and active motions to be used differ from those employed in treating muscular rheumatism and neuralgias only in their degree of application. While in the former it is our object to call forth the greatest possible muscular activity in order to induce changes in the muscles and their nerves, in arthropathies, on the contrary, we are forced to proceed with the greatest possible care. Here the muscular contractions are only a means toward the end; their action is simply the mechanical one of causing the articular surfaces to rub upon each other and thus grind away any existing roughness, while the motion of the tendons is calculated to loosen those fibrinous bands of exudation which surround them in the neighborhood of the affected joint. Considerable experience and judgment are requisite to estimate the force and rapidity with which the movements should be executed, and, consequently, these cases should never be treated by any but a physician.

The *modus operandi* in each case will be indicated by the mechanism of the particular joint to be treated, which sometimes will be found to be immovably fixed. At first the tissues surrounding the joint are to be gently rubbed, using in the beginning the finger-tips only; later, the force may be increased. As soon as the part has, in a measure, become accustomed to

[1] Ziemssen: Massage with the hot douche and in the hot bath. Deutsche med. Wochenschr., No. 34, 1877.

the pain, the passive motions, suitable to the joint, may be begun.

The following general precautions should never be lost sight of in executing this class of manipulations:

The joint must be supported by the physician's left hand, while with his right the passive motions are performed, proceeding very cautiously in the beginning. The adhesions existing within and around the joint may be of so firm and resistant a nature as to readily lead to the belief in the existence of bony ankylosis. At first, the amount of motion obtained in the joint will be exceedingly small, but even with this we will be bound to rest satisfied, for an increase of mobility often does not begin for months; in the meanwhile the patience of both physician and patient will necessarily be put to a severe test. Nevertheless—keeping the old saying, that "constant dropping wears away the rock," in mind—treatment must be continued steadily and systematically. The astonishing results which experienced mechano-therapists often obtain in cases declared incurable by others, can often be explained by the consistent and methodical treatment which they pursue.

In employing passive motion for the fingers and toes it will often require not a little dexterity to immobilize with the left hand the joints not intended to be moved. For instance, should it be desired to flex and extend the second phalangeal articulation of any of the fingers, the physician's left hand will be obliged to fix both the first phalangeal and the metatarso-phalangeal joints. In manipulating the joints crepitation, caused by the friction of the uneven articular surfaces upon each other, or by the periarticular exudations, is usually experienced. Occasionally it is so marked as to be actually audible. I have found it to be most common in the joints of the hand.

The knee-joint is very often the seat of extensive synovial exudation in consequence of chronic rheumatism. Resorption is to be effected as in synovitis in general, namely, by centripetal rubbing, and by pressing and kneading. When, as is not uncommon, chronic muscular rheumatism is combined with that of the joints, the muscles will have to be treated as well.

Every ten or twelve days it is well to allow our much tried patient a day of rest. The very anticipation of this holiday will enable him to endure all the more uncomplainingly the tortures to which he is unavoidably subjected.

Often in spite of every precaution slight inflammatory symptoms may present themselves—an indication to cease mechanical treatment at once. As a rule, rest and antiphlogistic treatment allay the inflammation in a few days, and in three or four weeks the joint can be manipulated again, and is usually less sensitive than before.

Case VIII.—Mrs. H. W., aged twenty-seven. Always well up to her twenty-fifth year. On November 17, 1879, was taken ill with typhoid fever of so severe a form as to confine her to bed for three months. During convalescence, and while staying in a rather damp summer resort in Bohemia, she was attacked with acute articular and muscular rheumatism, preceded by pains in the chest, back, arms, and thighs.

On October 17, 1880, high fever set in, which was soon followed first by swelling of the carpal joints, and then successively of nearly all the joints and muscles of the body. The chief seats of inflammation were the periarticular tissues, the insertions of the extremital muscles, and especially all the joints of the fingers. The acute febrile stage lasted about ten weeks. Salicylic acid could not be tolerated, but immobilization of the joints gave some relief, and for days both the lower and the upper extremities lay in splints. There were glandular enlargements in the neck, axillæ, and groins. A subacute stage followed the acute, during which the patient managed to pass part of the time on a sofa, or even sitting up, but the swelling, stiffness, and pain in the whole motor apparatus still persisted, preventing any but the most limited use of the extremities.

Massage undertaken at this time (by Prof. Gussenbauer) could not be continued, as it produced febrile exacerbations, acute glandular enlargements, and increase of the articular swelling and pain.

By July, 1881, the patient still could not rise unaided from a seat, could take only a few steps about the room, and was

quite unable to go up stairs. Writing, and the use of the fingers involved in handling a knife and fork, were still very difficult. At the same time she was subject to an irregular recurrence of very violent paroxysms of pain in the limbs, occasioning much loss of sleep. The urine deposited a thick sediment; the pulse was increased in frequency; the temperature had gradually become normal. There were no changes discernible in the internal organs.

July 10, 1881, the patient, accompanied by her husband (himself a clinical professor), came to Aussee for treatment.

All joints of the fingers, wrists, elbows, shoulders, hips, knees, and ankles I found to be involved, the toes only remaining untouched.

In both knees there was an abundant synovial exudation, quite evident on visual inspection alone, and extending three centimetres below each patella.

On beginning treatment the time occupied daily was between thirty and forty minutes, and though causing much pain and exhaustion, was, on the whole, well borne by the lady, who possessed much resolution and self-control.

In five weeks the exudation about the patella had notably diminished in consequence of kneading, while the motility of both upper and lower extremities had quite sensibly increased.

In six weeks she was able to rise from a seat without help, and in two months could, without fatigue, take a walk of half an hour's duration; whereas, on her arrival, she was barely able to drag herself from her own room to the dining-room.

Her gait, which had, in the beginning, been lame and faulty in every respect, improved so, that the progress made from week to week struck all who saw her. Going up stairs, too—at one time impossible—was an accomplishment she once more learned. The use of her fingers at meals as well as for sewing gradually returned, and she felt herself in consequence not a little rewarded for all the pain so heroically borne.

The original fixed partial flexion of the forearms still persisted to some extent, the elbow remaining slightly bent. The sensibility of the joints also, though much less, still continued.

The movements of flexion of the fingers had become much

freer—still the patient was a long way off from being able to make a fist.

On the other hand, she was now able to execute the movements of sitting and rising again, kneeling, running, arm-circling, shoulder-hitting, etc., which at the beginning of treatment were quite impossible.

On leaving, after ten weeks of treatment, she had the satisfaction of stepping unaided into her carriage, into which she had formerly to be lifted. Mechano-therapy had, to sum up, been in her case of the greatest benefit, a fact more especially appreciated by all who at her home in Prague had known her former helpless condition.

I am under the impression that treatment was continued in Prague, without, however, leading to complete restoration. In the autumn of 1882 the patient spent some time in the Grotto of Monsumano, hoping to get rid of the remainder of the joint stiffness. From her husband's reports I judge her condition is not yet entirely satisfactory, the pains in the knees and thighs being especially obstinate, so that she is again considering the advisability of undergoing mechanical treatment.

I have purposely presented a case in which, in spite of skilled and continuous treatment, as well as of great fortitude on the part of the patient, only partial cure was obtained after all, in order that the beginner, who may have a similar case to treat, shall not lay his want of success entirely to his own supposed lack of skill.

In closing my remarks on this class of diseases, I will cite the opinions of a great surgeon in this connection, which are the more valuable since they are taken from an article written to combat the extreme tendencies of mechano-therapy, and to relegate it to its proper sphere.[1]

According to Billroth: "The sequelæ of sprains and chronic rheumatic arthritis" (stiffness and tenderness) "yield so slowly to the usual means, that we should gladly hail a method accomplishing the desired end more quickly." He closes with these words: "I can only agree with the opinions of my col-

[1] Billroth: A discussion of some of the surgical questions of the day. Wiener med. Wochenschr, 1875, No. 45.

leagues Von Langenbeck and Esmarch, that for suitable cases massage deserves more recognition than it has received in Germany during the past few decades."

Treatment of Eye Diseases.

In treating the eye on mechanical principles gentle manipulation alone is the only one of all the various forms of mechano-therapy available.

Two kinds of manipulation may be used. Either pressure made upon the eyeball generally, or friction of the lid upon the cornea.

By means of the first, obstructions existing in the circulatory channels are removed, and freer outlet given to the humors of the eye. Exudations can thus be forced out of the eye to be removed by the general circulation. There can be no doubt that persistent pressure exerted upon the ball for some time perceptibly lowers, for a while at least, the intraocular pressure.

By friction, fresh inflammation is set up in old organized exudations, which, on account of the increased supply of blood it induces, leads to a removal of the deposit. The principle of this latter effect of mechano-therapy was employed years ago by F. Jäger, Sr., who inoculated blennorrhœic pus for the removal of pannus.

According to Schenkl,[1] Donders, at the Ophthalmological Congress in London, 1872, was the first to recommend kneading for certain corneal affections; but it was Pagenstecher who first really systematized ocular mechano-therapeutics. From time to time various clinical contributions have been made by Gradenigo, Chaudin, Petraglia, Just, and Friedmann; and Klein[2] has summed up our present knowledge of the subject in a series of recent contributions.

According to the unanimous opinion of the most eminent oculists, the application of mechano-therapy is suited to the following diseases of the eye:

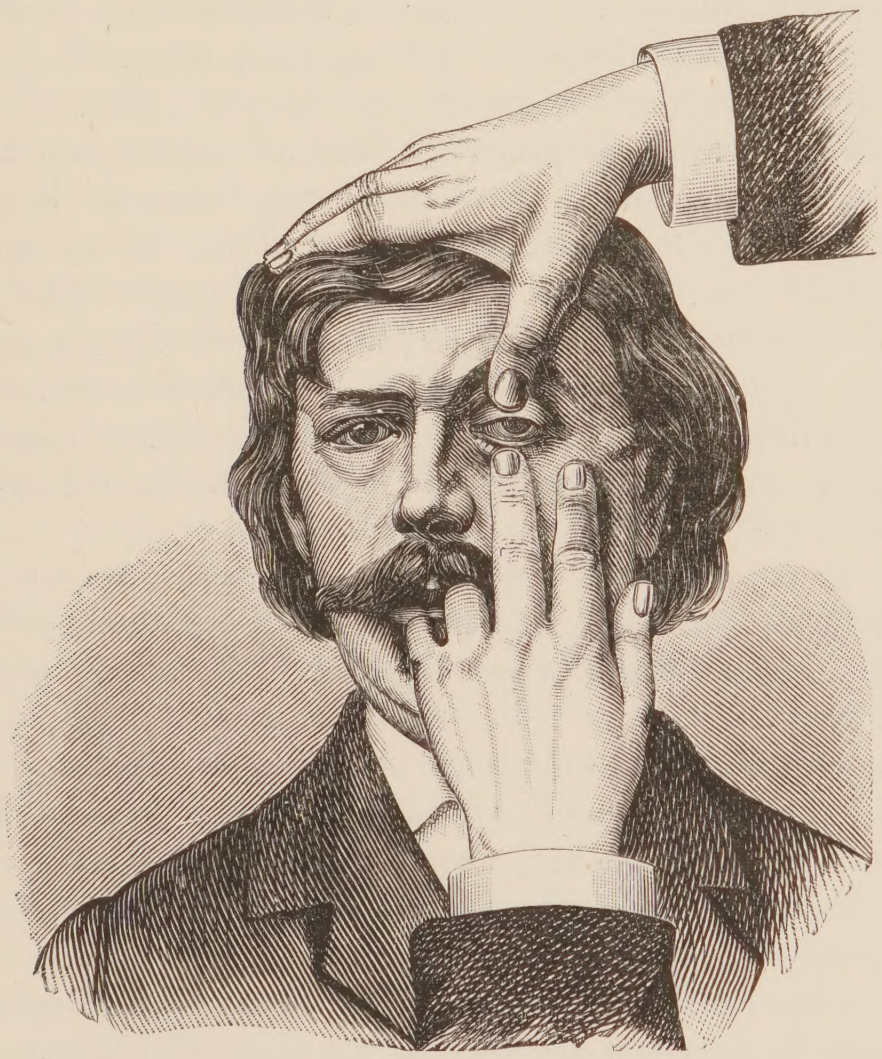
[1] Schenkl: Some of the newer points in the treatment of eye diseases. Prager med. Wochenschrift, 1882, No. 30.

[2] Klein: On the application of massage in ocular therapy. Wiener med. Presse, 1882, Nos. 9, 10, 12, 15.

1. Conjunctivitis pustulosa. 2. Conjunctivitis marginalis hypertrophica. 3. Episcleritis subacuta et chronica. 4. All varieties of corneal opacities capable of being cleared—as those following pannus, and scrofulous and parenchymatous keratitis.

Upon Gradenigo's showing that in the healthy eye the intraocular pressure could be diminished by mechanical pressure for two to six minutes, this procedure was applied to the treatment of glaucoma, and its beneficial effect in reducing the intraocular tension has been confirmed by Wicherkievicz, Schnabel, and Klein.

FIG. 59.



The accompanying drawing (Fig. 59), kindly lent me by Schenkl, shows the method of applying treatment. According to the seat of the trouble, either the upper or lower lid is fixed by the thumb of the operator placed near its ciliary

edge, and then friction is made upon the ball. Pagenstecher recommends that the lid which is not being used be slightly retracted from the eye by the unoccupied hand. He employs both circular and radial friction, preferring, however, the latter, which is performed by rubbing from the centre of the cornea outward toward the equator of the ball. In this manner any given sector of the eye may be treated separately.

Klein employs radial massage for local, and circular for general lesions, and both he and Pagenstecher direct that the motions should be performed rapidly, strong pressure being carefully avoided; the lid should be made to simply glide gently back and forth over the bulb.

Klein has attempted to establish the maximum of pressure which may be employed, by taking as a standard the force necessary to produce a contraction of the iris sufficiently strong to retract a prolapsed portion. Schenkl asserts that the employment of moderate pressure during massage is neither disagreeable to the patient, nor is it followed by any subsequent signs of irritation. The degree of pressure, he asserts, should be measured according to the desired effects; thus, the removal of purulent effusions from the anterior chamber will call for a different amount of pressure than when it is desired to cause, according to Chaudin's method, the resorption of portions of the lens.

The rubbing should not last longer than from one to five minutes, nor should it be performed oftener than once daily, except in such cases where rapidity of cure is especially called for.

Pain will only be complained of when iritis exists. Redness of the conjunctiva usually follows the rubbing and lasts from fifteen to thirty minutes, except where conjunctivitis exists, when it may continue for one or two hours. On the whole, the period of irritation diminishes from day to day.

The best results of ocular massage are obtained in cases of long-standing corneal opacities, as shown by the following case of Schenkl's.

A. H., aged eighteen, suffered for the past seven weeks from corneal opacity following keratitis parenchymatosa. With the exception of a narrow peripheral border, the opacity included

the whole cornea, being most dense at the centre. All sorts of irritants, as white precipitate, calomel, tincture of opium, hot applications, etc., were used without effect. Rubbing the eyelid upon the cornea, together with the use of an ointment of yellow oxide of mercury (0.05 to 2 of vaseline), was then ordered, and after three applications the opacity began to disappear—first in the centre, then in spots along the periphery gradually extending toward the centre.

Pagenstecher asserts to have seen good results in old, long-standing cases, and records cures of opacities that had lasted for thirty years or more.

Klein was the first to attempt the mechanical treatment of keratitis in its acute stage, and in one instance he succeeded in aborting the inflammation after three days treatment, in a patient in whom a keratitis of the other eye, on a former occasion, had required six weeks for a cure under the old methods of atropia, hot applications, etc.

With regard to the simultaneous application of ointments authorities differ. Pagenstecher always uses an ointment of yellow oxide of mercury, while Klein and Petraglia admit of none, in order to obtain results free from any ambiguous interpretation. Schenkl at first used no ointments, but as he found that the attendance at his clinic fell off when the patients saw that they received no medicine of any kind, he returned to the use of some indifferent ointment.

The cases of episcleritis cured in three to ten sittings, published by these authorities—Pagenstecher, Klein, and Schenkl—encourage to the more frequent use of massage in this affection; the more so as under ordinary treatment the disease usually lasts several months.

Latterly the mechanical treatment of glaucoma has been advocated. Klein has formulated the indications for its use. These are, first, acute and chronic glaucoma, beginning with inflammatory symptoms and accompanied by increased intraocular tension; second, cases where sclerotomy and iridectomy have proved ineffectual; third, glaucoma accompanied by continual neuralgia, rendering operation impossible; fourth, glaucoma in which operation seems directly contraindicated, as in the hemorrhagic form.

Schenkl is inclined to regard the mechanical treatment of glaucoma less favorably, except where the disease is secondary. But he recommends it for the treatment of hemorrhage into the anterior chamber, and for conjunctival ecchymosis. Klein thinks it may still prove useful in cases of obstinate ciliary neuralgia, of blepharospasm, and of supraorbital neuralgia.

Personally, I have had no opportunity to test the efficacy of mechanical measures upon the eye. I have, however, seen many cases of supraorbital neuralgia, but have never observed anything more than temporary relief afforded them by massage.

GROUP III. MECHANO-THERAPY OF CHLOROSIS; CHRONIC CATARRHAL GASTRITIS; PULMONARY PHTHISIS; HYSTERIA; HYPOCHONDRIA; AND DIABETES MELLITUS.

In all the above conditions, which, with the exception of chronic catarrhal gastritis, depend upon some congenital morbid tendency, the aim of all treatment is to modify, both qualitatively and quantitatively, the processes of nutrition. The uselessness of all medication in these diseases has long been recognized. Quinine and iron alone have retained their reputation as general tonics; still, even these remedies occupy but a secondary place compared to change of climate, sea bathing, hydrotherapy, milk cures, etc. Neurasthenia, hysteria, and hypochondria—all three so intimately related—are often a favorite field for the application of electricity, an agent which in the last few years has come into such active competition with mechano-therapy. As stated before, mechano-therapy can do but little in these cases unless seconded by a treatment aiming at a general elevation of the tone of the body as a whole.

The influence which mechano-therapy exerts in the cure of these cases will vary considerably. It is smallest, perhaps, in chlorosis and chronic gastritis, where it is forced to share the honors with hydrotherapy, while it is greatest in certain forms of phthisis, though here much of the beneficial result must be laid to the effects of a simultaneous resort to high altitudes.

It would be hard to establish any definite data regarding its effects upon neurasthenia, hysteria, and hypochondria, for with

the multiform symptoms which these affections present, the success of mechano-therapy in any particular case will entirely depend on the class of symptoms which occur. Sometimes a great deal may be accomplished, in others very little.

For the treatment of this group of diseases considered as a whole, the following physiological principles should be kept in mind.

The muscles being the chief site of chemical change occurring in the body, stimulating and increasing their action leads to increased oxygenation of the blood; to greater combustion of oxygen and elimination of carbonic acid; to increased metabolism and consequently to greater desire for food and to better digestion; to production of more and better blood; to improved nourishment of the nervous system; to an increase, both in number and strength, of the muscle fibres; to the endowment of the whole body with vigor and elasticity, and to a consequent revival of all the mental faculties.

While these then are the principles of treatment, their application to the individual diseases of which the group is composed will require considerable variation.

In chlorosis and phthisis, for instance, active movements take precedence over mechanical manipulations, while chronic gastritis will demand the use of both forms. In neurasthenia, hysteria, and hypochondria, all forms—passive, active, and mechanical—are called into play, first one, then another preponderating.

In *chlorosis* the bloodvessels are both thin-walled and of narrow calibre, and we must seek to strengthen them through active exercise, which stimulates cardiac activity and increases the blood pressure. The augmented hæmic oxygenation thus brought about leads both to an increase in the number of red corpuscles as well as of the amount of hæmoglobine contained in each. At first, owing to the general lassitude of which chlorotics suffer, exercise will have to be of a very gentle nature. Often, indeed, it will be necessary to begin with such passive motion as is afforded by driving or by passive muscular exercise, or the patient may be subjected to a thorough rubbing and kneading.

In *chronic gastritis* mechano-therapy, like hydrotherapy, can

only be of use as an adjuvant to specific treatment. Much can be done, however, by gymnastics, to remove those circulatory disturbances which are such a fruitful cause of the so-called secondary catarrhs of the stomach, and which, according to Oser,[1] form by far the greater number of all the cases of chronic gastritis. The very best results are obtained from mechano-therapy in the cases of gastritis accompanying chlorosis and anæmia, and here all of the more active forms of exercise are demanded, such as riding, running, fencing, mountain-climbing, and the like.

In *phthisis* mechano-therapy is only applicable in non-febrile cases. In these we strive by muscular exercise to cause, through more energetic oxygenation of the blood, resorption of infiltrations already formed. Or we use it prophylactically for delicate, narrow-chested, anæmic persons of consumptive parentage. For these the aim of mechano-therapy is two-fold. 1. Improvement in the quality of the blood, with increase in the amount of oxygen in the lungs, followed by improvement of nutrition generally. 2. By exercise of the respiratory muscles to deepen the respirations and increase the capacity of the thorax. Living in the mountains, or the inhalation of oxygen or ozone, as recommended by some, has the same ends in view.

On the occurrence of fever or of hemorrhage at any time, mechanical treatment must at once be abandoned—three months at least should elapse before treatment is resumed after a hemorrhage.

So far as I know, Brehmer was the first to prescribe walking up an ascent in certain cases of lung trouble. He caused walks to be laid out, containing varieties of ascending grades; different ones being ordered for different patients.

It would be erroneous to suppose that exercise is gymnastics for the lungs alone. The benefit that is derived from it arises as much from increased metabolism of the muscles, from augmented heat production, and the improved function of all the organs. Many physicians have recommended deep inhalations, repeated several times daily, for the purpose of expanding the

[1] Oser: Real Encyclopädie der gesammten Heilkunde, viii. Band, Wien und Leipzig, 1881.

chest. Years ago I too was of opinion that some good might be effected in this way, and perhaps it really might be of use if the patient could be made to always substitute long, deep respirations for the usual shallow ones. The method pursued by Bicking[1] is rather better than the preceding. .He holds that the thorax should be dilated by the lungs from within outward, the respiratory muscles only aiding in the act. Exercise alone, without special pulmonary gymnastics, he asserts to be insufficient, and if by exercise he understands simply easy walking, I quite agree with him. On the other hand, if the kind of exercise which I shall shortly describe be used, there will be no call for any special form of lung gymnastics.

Bicking makes his patients use an apparatus constructed on the plan of a *narghileh*, or water-pipe. The effort of drawing air through the resistance offered by the water is often very great, requiring the use of all the respiratory muscles. The treatment of lung troubles by inhalation, so much in vogue within the past decade, has abundantly shown that long-continued inspiratory efforts invariably produce fatigue, so that now when treatment is to be continued for more than an hour, the patient is placed in a room, the air of which is impregnated with the substance to be inhaled.

Bicking asserts that active bodily exercise causes greater rapidity, but not increased deepening of respiration, and that the excessive sweating, and the short, superficial, difficult breathing, weaken rather than strengthen the lungs. My observations go to show, on the contrary, that by active exercise both the frequency and volume of respiration are increased.

Muscular exercise has this great advantage over simply deep breathing, that it brings about an increased oxidation in all the muscles which reacts beneficially upon the system at large. Whereas, by deep inspiration alone, only the intercostals, the triangularis sterni, and the scaleni muscles are affected.

The increased consumption of oxygen brought about by muscular activity, is in itself sufficient to cause augmented pulmonary activity, and the improved appetite which follows

[1] Bicking: Respiratory Gymnastics; a cure for various diseases, but especially phthisis. Berlin, 1872.

is an indubitable sign of the likewise improved nutritive processes which have begun in the organism.

A daily walk over some elevation, which going and coming would occupy from half an hour to an hour, would in all probability be quite sufficient for the achievement of our purpose. For delicate persons a well-kept, even road should be selected.

Since various obstacles may arise to this form of exercise—as inclement weather, the tendency on the part of the patient to overdo the matter, and thus incur fatigue, etc.—and as it is desirable for the patient to be constantly under the care and guidance of a physician, the following forms of exercise may be pursued in the house instead.

For patients of phthisical inclination, or for those with narrow chests, and of poor development generally, the following exercises are suited.

I. Exercises without Apparatus.

1. Shoulder raising, with and without dumbbells. (Fig. 60.)
2. Arm raising sideways, with and without dumbbells. (Fig. 61.)
3. Arm raising forward, with and without dumbbells.

Fig. 60.

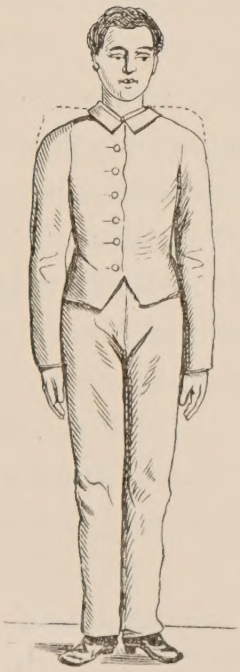


Fig. 61.

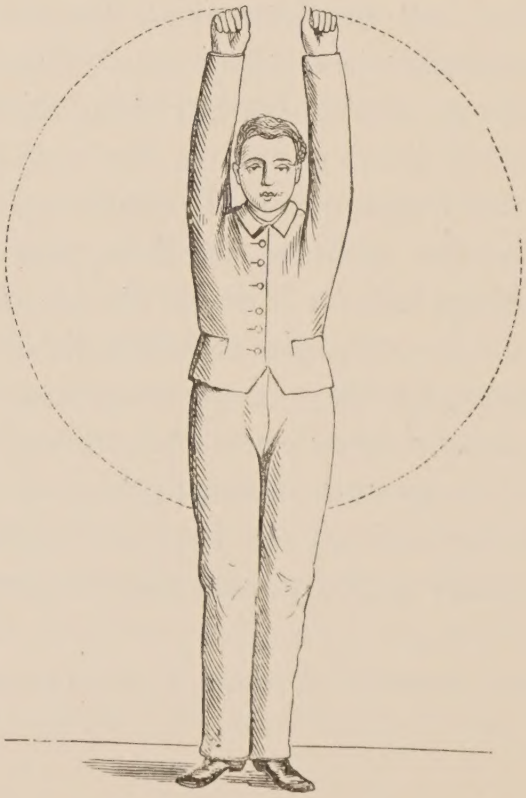


Fig. 62.

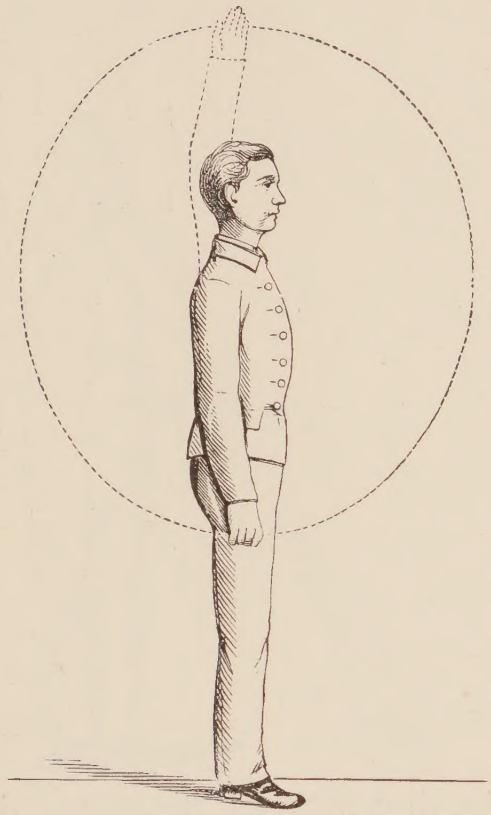
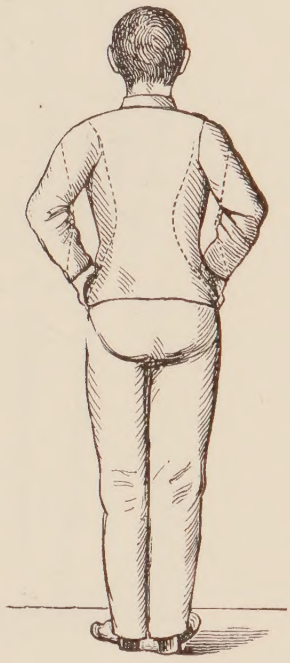


Fig. 63.



4. Arm circling. (Fig. 62.)
5. Touching elbows behind. (Fig. 63.)

Fig. 64.

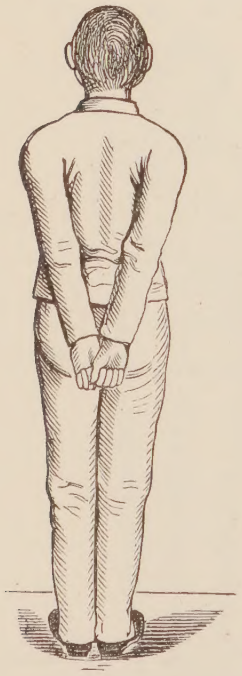
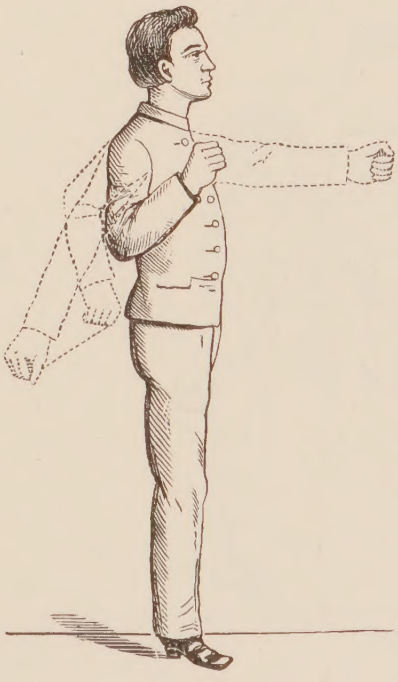


Fig. 65.



6. Clasping hands behind. (Fig. 64.)
7. Shoulder hitting forward, first without, then with, dumb-bells. (Fig. 65.)

Fig. 66.

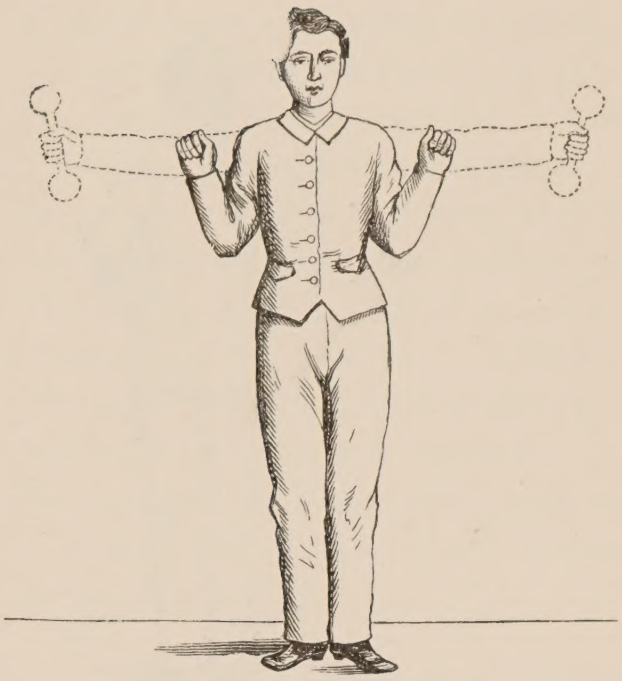
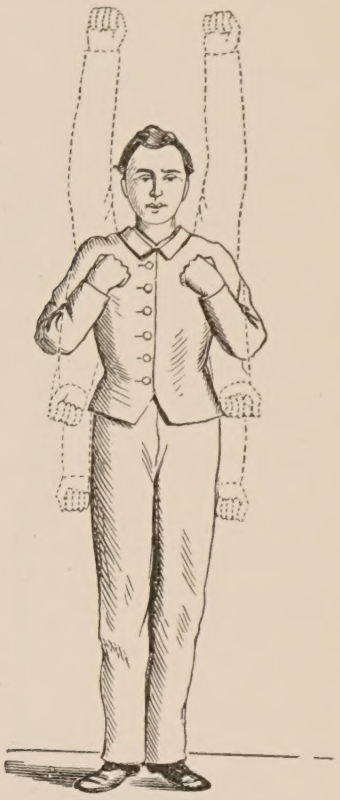


Fig. 67.



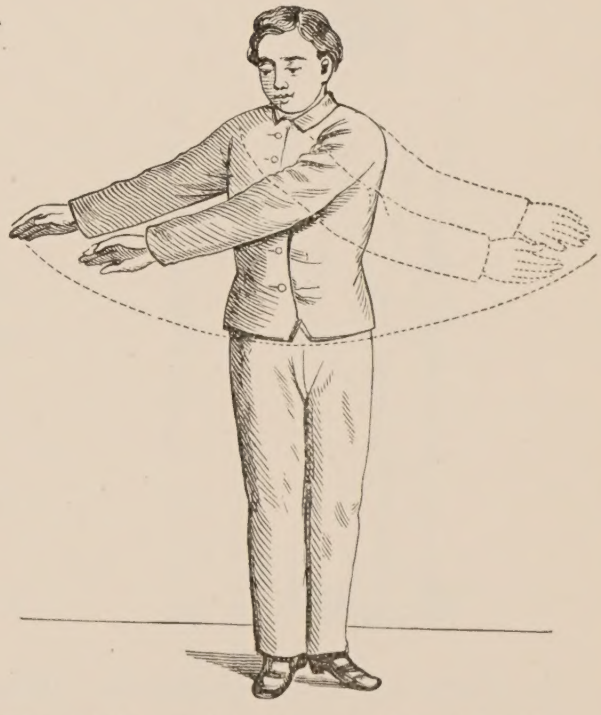
8. Shoulder hitting sideways, first without, then with, dumbbells. (Fig. 66.)

9. Shoulder hitting upward and downward. (Fig. 67.)

10. Swimming motion, both with and without dumbbells.

Fig. 68.

Fig. 69.



11. Sawing motion (Fig. 68), with and without dumbbells.

12. Mowing motion (Fig. 69), with and without dumbbells.

Fig. 70.

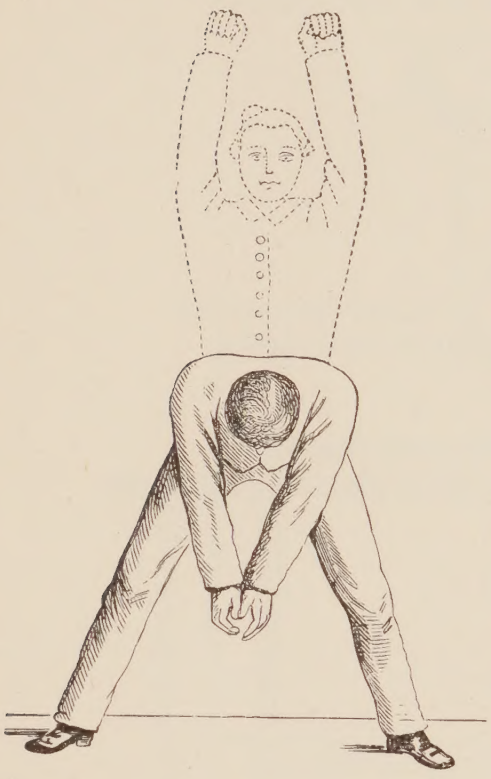
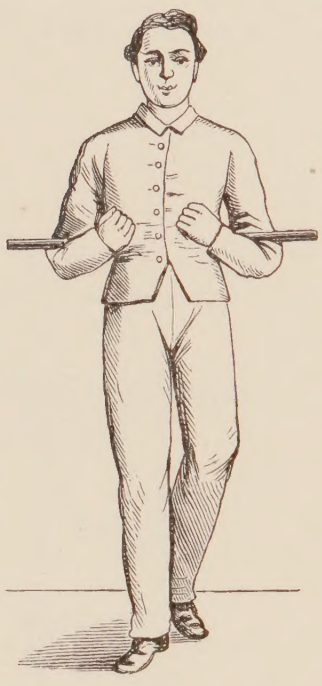


Fig. 71.



13. Hewing. (Fig. 70.)
14. Walking with a wand through both elbows. (Fig. 71.)

Fig. 72.

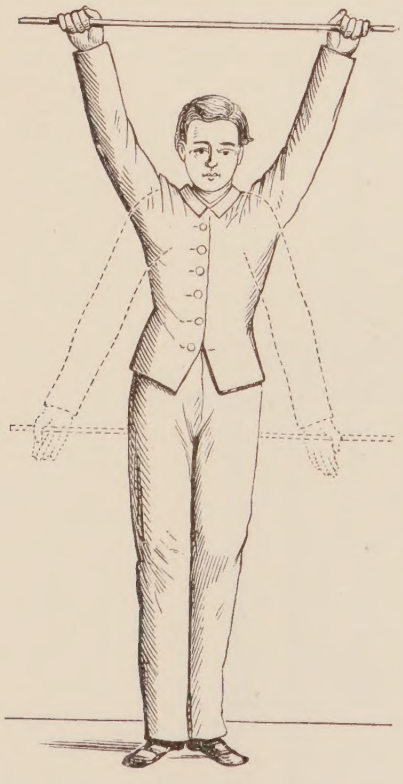
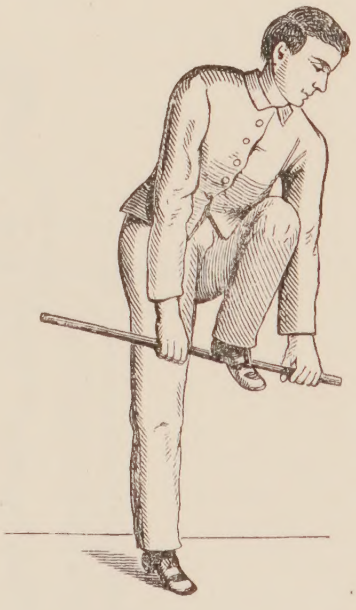


Fig. 73.

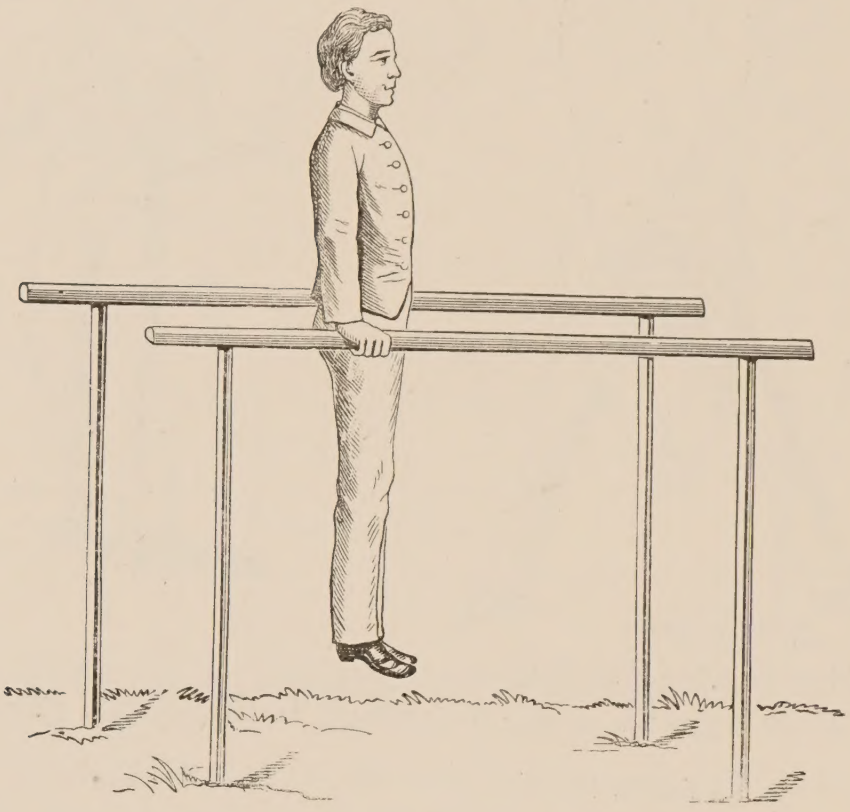


15. Swinging wand back and forth over head. (Fig. 72.)
16. Stepping over wand. (Fig. 73.)

II. Exercises with Apparatus.

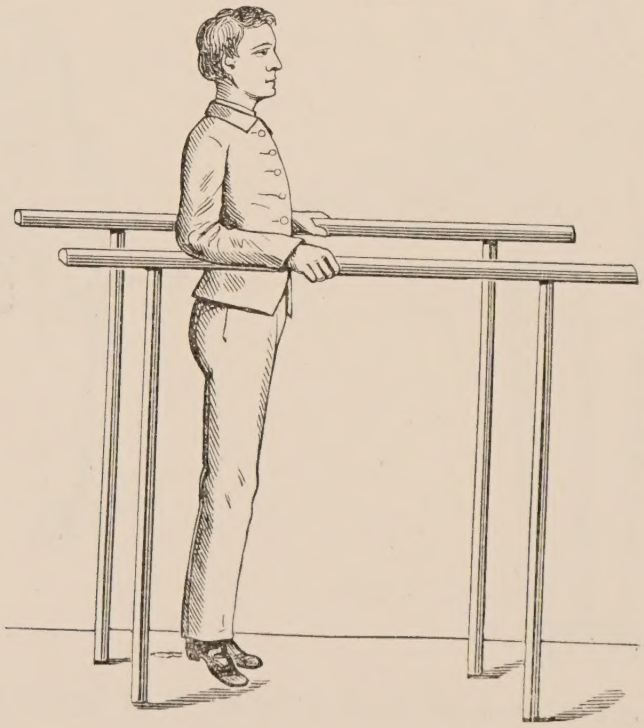
a. On the Parallel Bars.

Fig. 74.



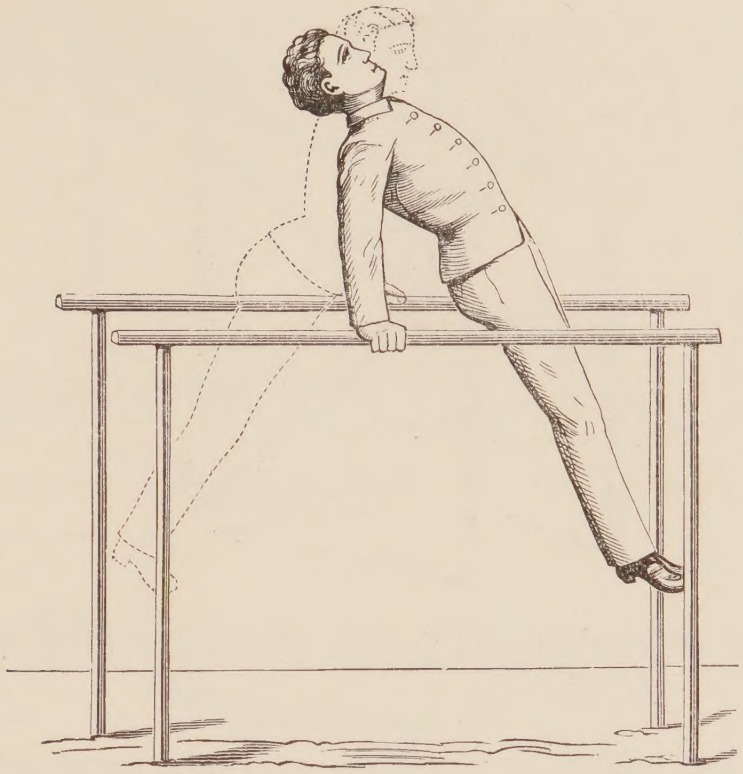
1. Stiff arm rest. (Fig. 74.)

Fig. 75.



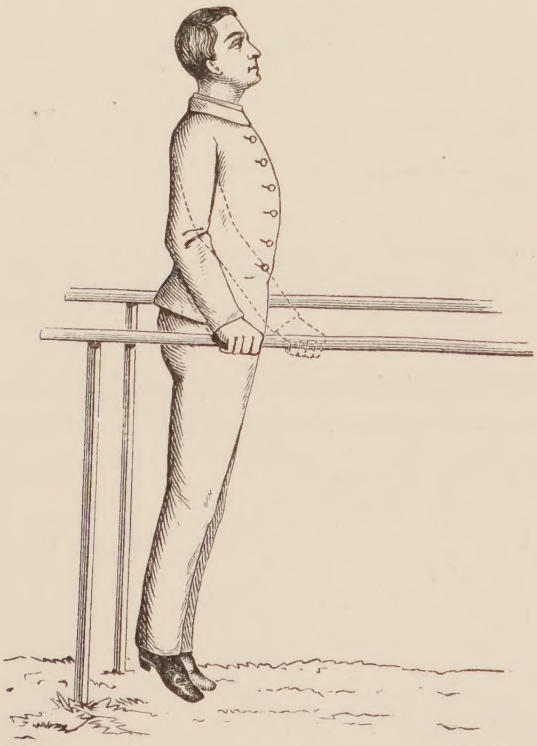
2. Stiff elbow rest. (Fig. 75.)

FIG. 76.



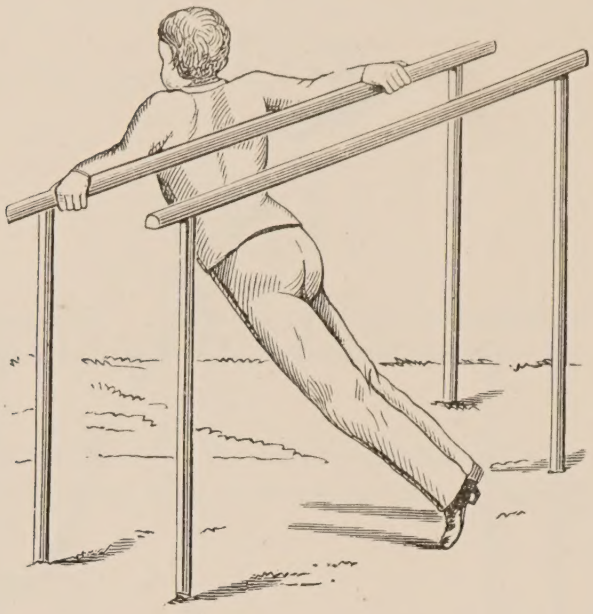
3. Swinging in arm rest. (Fig. 76.)

FIG. 77.



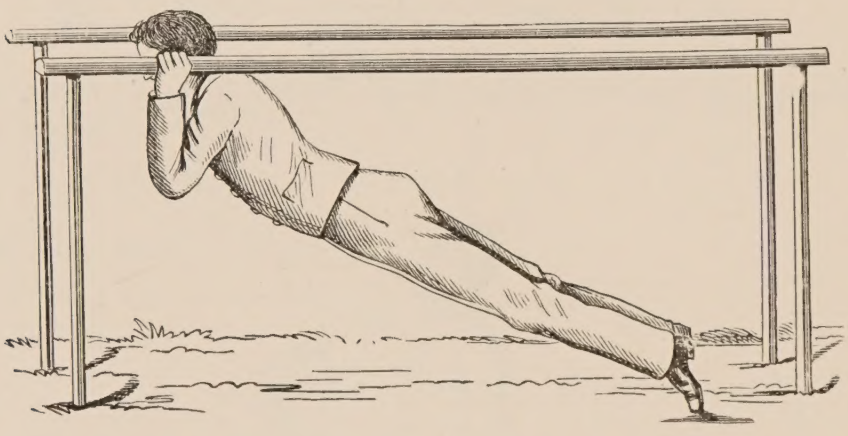
4. Hand walking—alternating. (Fig. 77.)

Fig. 78.



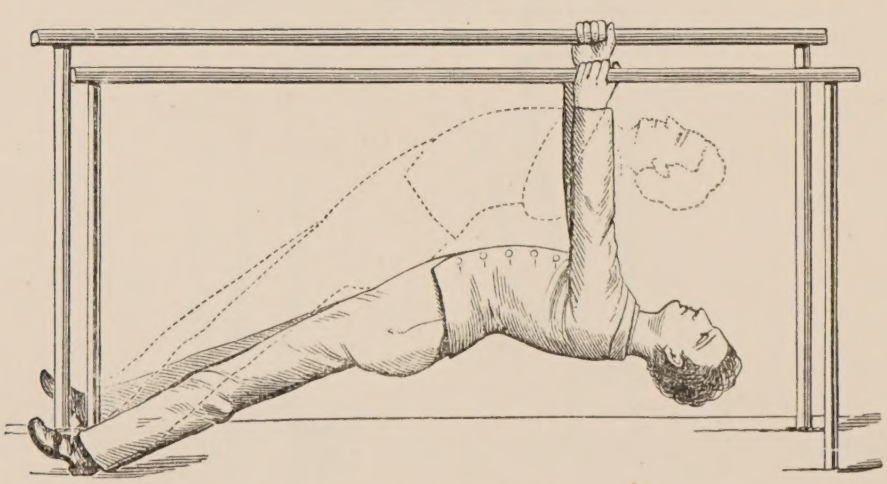
5. Chest expansion—feet under the bars. (Fig. 78.)

Fig. 79.



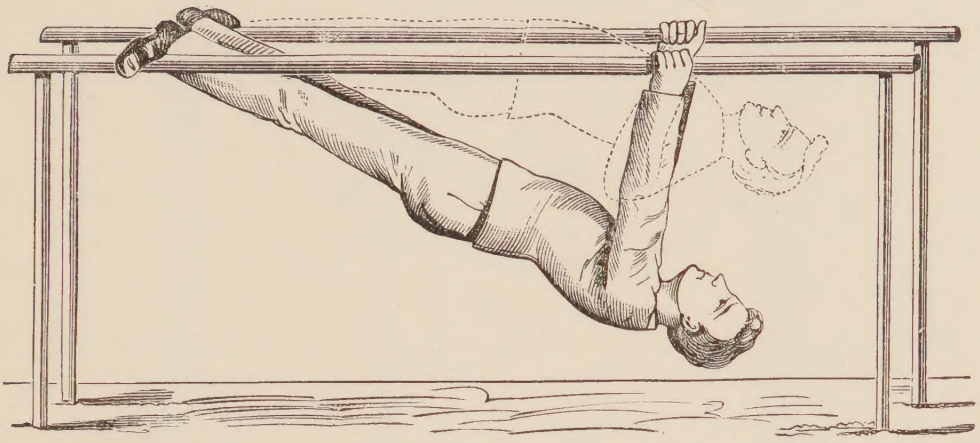
6. Hanging with feet supported—downward. (Fig. 79.)

Fig. 80.



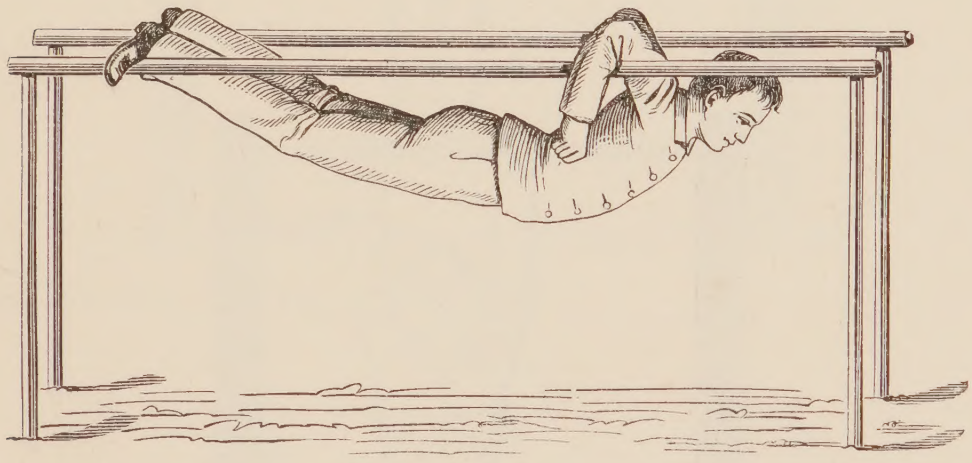
7. Hanging with feet supported—upward. (Fig. 80.)

FIG. 81.



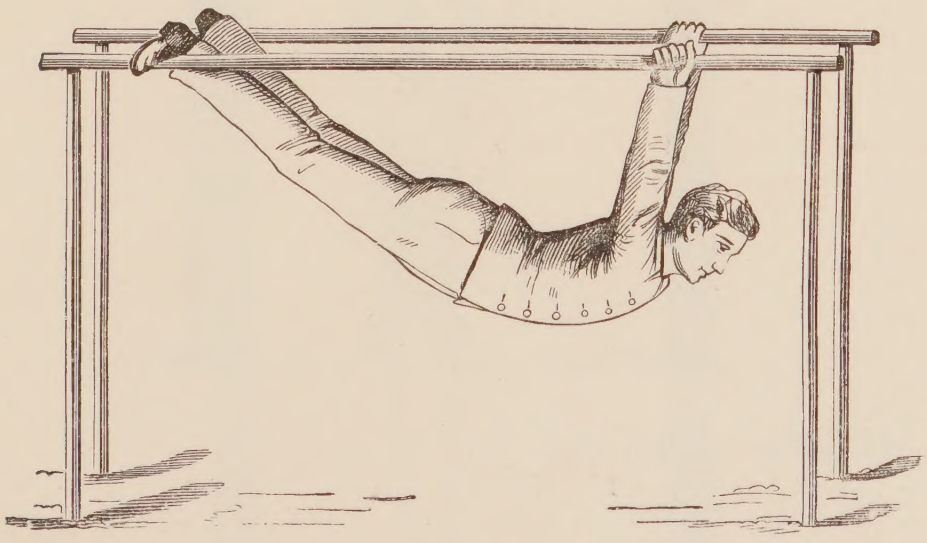
8. Balance, upward. (Fig. 81.)

FIG. 82.



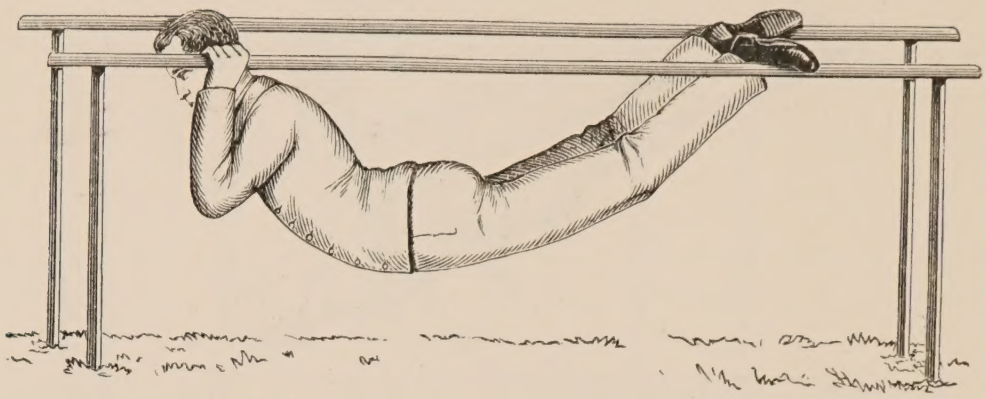
9. Balance, downward. (Fig. 82)

FIG. 83.



10. Chest expansion, inside grip, feet on the bars. (Fig. 83.)

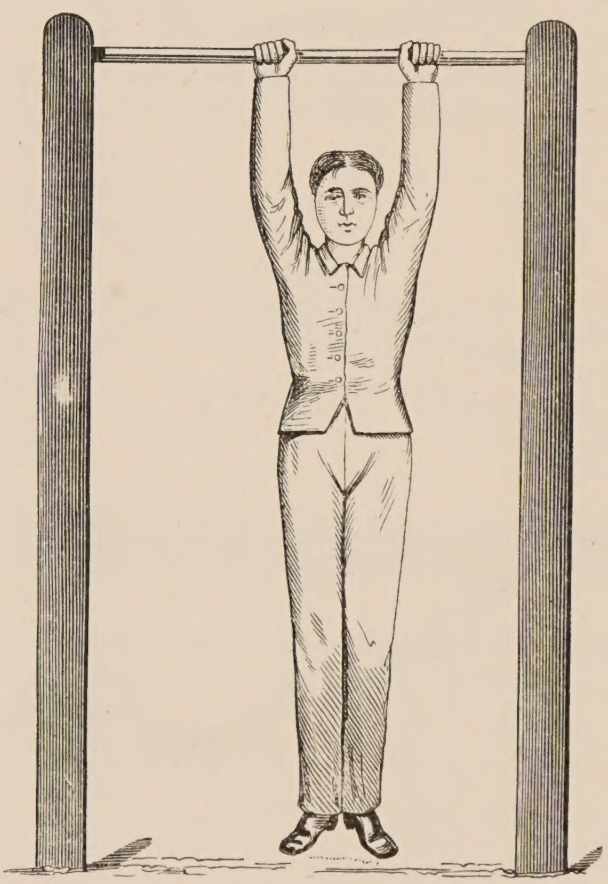
FIG. 84.



11. Hanging, outside grip, feet on bars. (Fig. 84.)

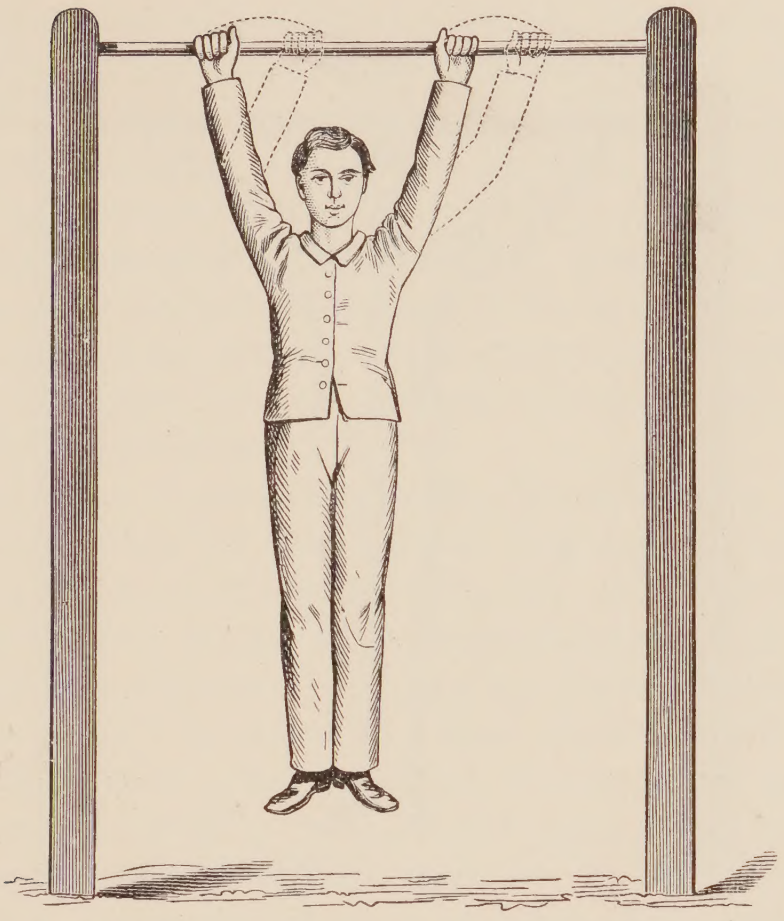
b. On the Horizontal Bar.

FIG. 85.



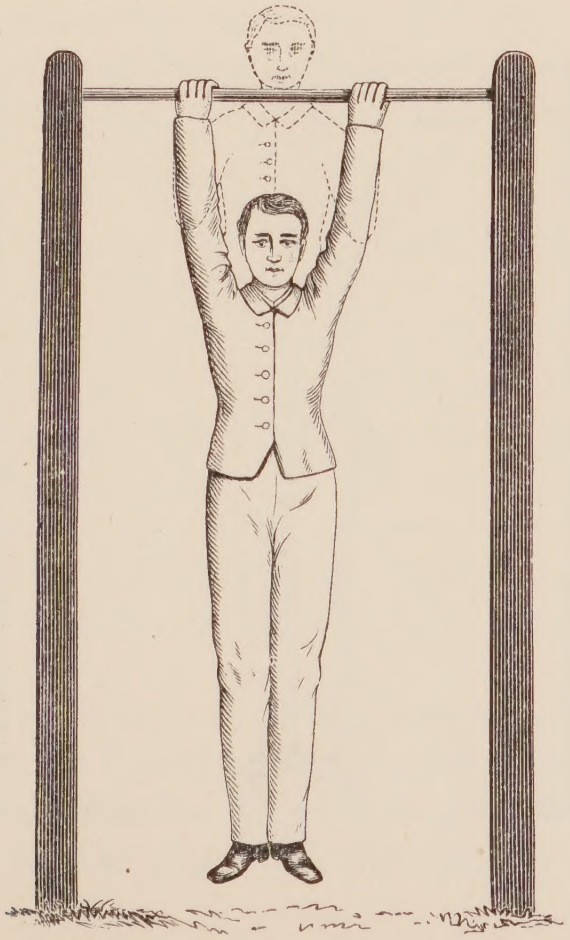
1. Hanging. (Fig. 85.)

FIG. 86.



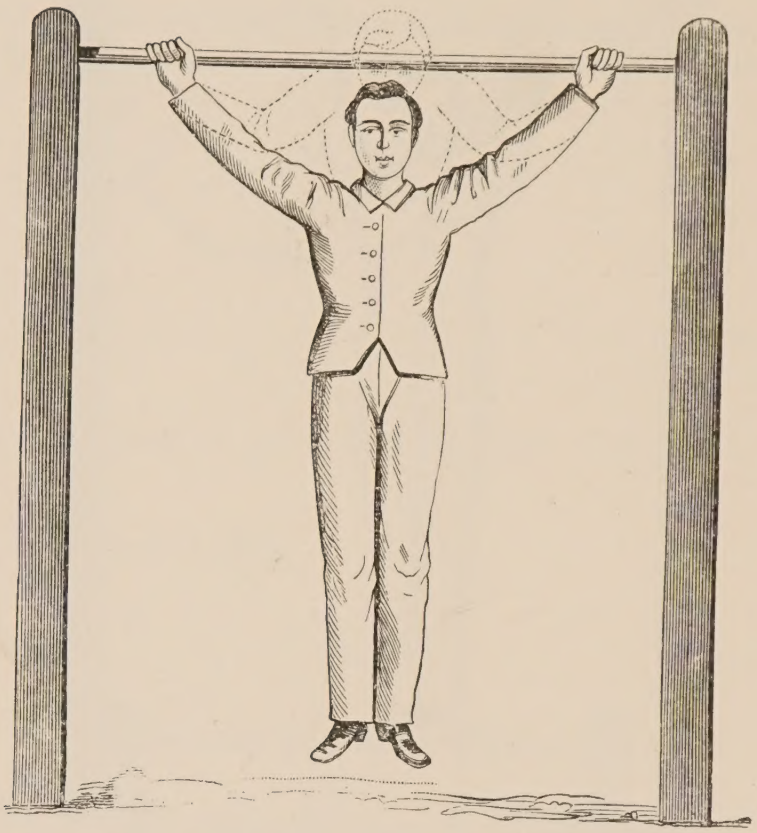
2. Walking the bar. (Fig. 86.)

FIG 87.



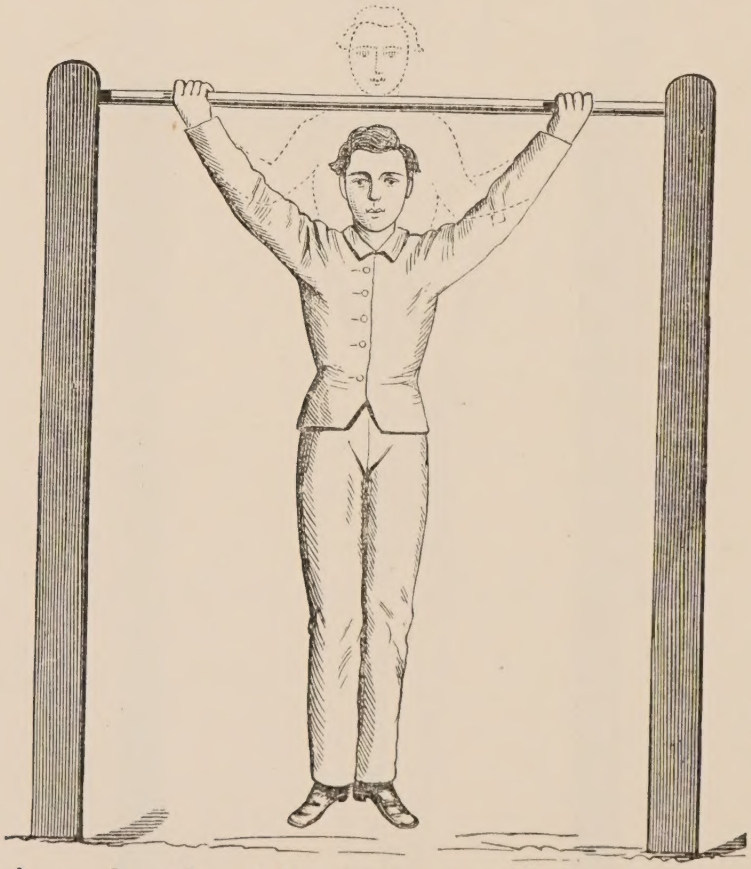
3. Chinning. (Fig. 87.)

FIG. 88.



4. Chinning—hands wide apart, grip in front. (Fig. 88.)

FIG. 89.



5. Chinning—hands wide apart, grip behind. (Fig. 89.)

Since horizontal and parallel bars are forms of apparatus easily put up in any room, every physician should make himself familiar with the exercises to be performed upon them. There is hardly a busy practitioner who has not frequently to treat a young person for incipient phthisis. A suitable climate and plenty of nourishing food will be prescribed, but how seldom is a systematic development of the chest recommended. Yet I venture to say that the use of methodic gymnastics, such as I have laid down, will be of more use than any of the most highly prized medicaments.

The physician should, if possible, himself direct the daily round of exercises, for they gain in this way an importance, both in the eyes of the patient himself and of those about him, which they could not otherwise obtain. Fifteen to twenty minutes a day is all the time the physician need give.

Patients should be urged to repeat daily the exercises for themselves. Many young men and women fall an early prey to consumption largely because rest and quiet have been preached, instead of urging them so to strengthen their systems by active exercise as to successfully combat the disease. When once the disease has made advances, if the lungs are already infiltrated or softened, or if hæmoptysis and fever have occurred, then, to be sure, it is too late to attempt to do anything by gymnastics. Rest and nursing are then the only means of prolonging for a brief season the constantly declining powers.

In the mechanical treatment of *neurasthenia* and its allied affections, hysteria, hypochondria, and some of the milder psychopathies, we seek to attain a threefold end. First, to regenerate the mass of blood as a whole; secondly, to combat individual symptoms; and thirdly, to favorably influence the mental state. Beard, who claims for neurasthenia that it is a new, and especially American disease, considers mechanotherapy as not only essential in its treatment, but absolutely indispensable for those cases which it seems advisable to confine to bed.

This I am quite willing to admit, inasmuch as this class of invalids seem to be benefited by any new form of treatment, no one form in particular enjoying a preëminence. Change

of scene and mode of life are often sufficient, consequently where electricity or hydrotherapy has done good, still better results would most likely be attained by mechanical treatment, especially in cases where either special symptoms, or the condition in general seem to indicate it.

Amid all the numerous morbid manifestations accompanying neurasthenia, hyperæsthesia and muscular weakness are probably the most prominent, so that Arndt[1] has declared the nature of the disease to consist in *increased irritability, with rapid tendency to fatigue, especially of the muscular system.*

In neurasthenia, as in muscular rheumatism, all the morbid processes occurring in the muscles are more rapidly influenced by mechano-therapy than by either hydro- or electro-therapy. Of all symptoms the various hyperæsthesias most frequently engage the physician's attention. These are generally regarded by the friends as founded either on exaggeration or upon affectation. Patients complain of muscular pains especially in the extremities and back, and of pains along the spinal column, the latter being, indeed, considered quite characteristic of the disease ("spinal irritation").

Besides these, neurasthenics suffer from the greatest variety of symptoms referable to the brain, as headache and a feeling of weight or constriction in the head, eye-ache, photopsia, scotoma, roaring and ringing in the ears, hypersensitiveness to odors, and other similar idiosyncrasies. Or there may be liability to sudden changes of temper, or to depression and sadness, or dizziness or insomnia may exist. Indeed the large number of various feelings of apprehension experienced in neurasthenia has been the occasion for the manufacture, by various authors, of any number of "phobias." The restlessness so often seen in these patients is caused by the pains occurring in various muscle groups.

From the very fact that neurasthenia depends in a great measure upon an inborn tendency, and may consequently be regarded as an anomaly of constitution, the uselessness of drugs becomes at once evident, and any therapeutic measures, whether they consist in electricity, hydrotherapy, change of air, or mechano-therapy, will only then be effectual when they

[1] Arndt: Real-Encyclopädie der gesammten Heilkunde. Bd. ix. Wien und Leipzig, 1881.

bring about a radical change in the patient's whole mode of life. The treatment of these cases, consequently, so long as they remain within the influences of the family circle where apparently trivial causes are constantly influencing the patient, is often attended with many obstacles. Even change of scene will be useless if the deleterious home influence accompany the patient. They recover soonest in the busy life of a hydropathic establishment, where all necessary appliances are at hand, and where they can constantly consult a doctor on all their various aches and pains. In the management of the establishment they soon take an active interest, and the daily exercises performed in company with others afford a pleasant entertainment, as well as healthy stimulus to the mind.

The active motions to be used consist of exercises with and without dumbbells and with the wand, on the parallel and horizontal bars, on the inclined and horizontal ladder, on the spring-board, and, in short, in exercises of every kind suited to the strength and dexterity of the patient.

The putting on and off of the gymnasium suit twice a day is in itself often enough to put a neurasthenic patient in a good humor with himself, for he feels as though something were really being done for him, and as though somebody had an interest in his getting well. It is a very wrong principle to go on, to treat all complaints of these patients as due to imagination or affectation. To them all the unpleasant feelings they experience seem perfectly real.

General massage of the whole body, including stroking, kneading, muscle-hacking, etc., will be found more effectual in banishing the various anæsthesias and hyperæsthesias than electricity, while passive motions of all the large joints—flexion, extension, and rotation—cause a stretching of the nerves contained within the muscles, which reacts most favorably upon the mental state.

In contrast to a neuralgic patient, a neurasthenic longs for the hour of treatment, and I have been received with tears and reproaches, by such patients, for coming an hour later than I had promised.

In an establishment, treatment should be undertaken twice a day. It is not necessary that the manipulator should, for

these cases, be a physician, though it is well for the attending physician to superintend the exercises from time to time, if only for the patient's sake, for they require both attention and sympathy.

Case IX.—Mr. C. von M., a Russian, aged thirty-eight, was sent to me to Aussee from Meran, by Drs. Tappeiner and Hausmann, in order that the climate of this high valley might cure a condition which had caused him for some years to wander from one health resort to another.

Examination proved negative regarding the existence of any organic pathological condition, and yet the patient felt ill and miserable to the last degree. He could not walk ten minutes without fatigue. Anorexia was complete, and the bowels moved only on taking cathartics. This bodily condition had reacted most deleteriously upon the mind, for he was in a state bordering upon melancholy, his wife affirming she had not seen him cheerful for years, and that he had, indeed, quite forgotten how to laugh.

Tenderness along the spinal column, muscles flabby and small, complexion sallow and anæmic—all went to complete a picture of a typical case of neurasthenia.

A four weeks course of daily repeated active and passive exercises, lasting thirty to forty-five minutes, completely changed this apathetic, morose, taciturn, and disagreeable individual. He had now a tremendous appetite and a daily passage from the bowels, could walk for four hours without fatigue, and in place of his former melancholy disposition, a decidedly jovial nature appeared.

These remarks upon neurasthenia are equally applicable to hysteria, hypochondria, and those mild psychopathies connected with them, which Arndt and others regard as simply more marked grades of neurasthenia. If, for instance, to unnaturally rapid fatigue of the muscles, there is added a spasmodic condition, then the neurasthenic becomes converted into an hysterical or even epileptic state. Or if, instead of fatigue alone we have, following exercise, a period of mental excitement, either with or without feelings of oppression and dread,

then we have to do with a case of hypochondria or melancholia, or with an instance of "forced ideas" such as often precede some forms of insanity.

According to Arndt, a separation of neurasthenia from hysteria and hypochondria is quite impossible unless we set up all sorts of artificial distinctions. He considers the numerous terms of different authors—such as spinal neurosis, spasmophilia, spinal weakness or irritability, nervosism, erethism, the *nevralgie générale qui simule des maladies graves des centres nerveux* of Valleix, the *nevropathie proteiforme*, the *surexcitation nerveuse* of other French writers—as all but different names for one and the same condition. All writers agree, however, on the impossibility of permanently curing this condition, and above all, that no medicaments exist capable of permanently allaying the irritability of the hyperæsthetic nerves.

Gerhard[1] and other authors assure us that convalescence may begin quite suddenly at any time, no matter how alarming the symptoms appear to be. Nevertheless, these patients require careful medical supervision, their mode of life must be regulated, they must have plenty of sleep and fresh air, and be furnished with some pleasant mental occupation—as some form of literary entertainment, or music—as well as bodily exercise. The latter is best obtained by a daily course of carefully systematized exercise, this being more efficacious than electricity, if only for the reason that the patient's mind is thus pleasantly occupied for a couple of hours. The hydropathic establishments have so fully recognized the importance of mechano-therapy that they have, with few exceptions, embraced such a course within their programme. The moral influence which it is within the power of the physician to display in these cases is so great that it has given rise to the expression that "the physician, not the physic, cures."

The good result recently claimed for hypnotism in these cases is but fresh proof of the power of psychic influences, and in applying general faradization, massage, and all other therapeutic measures it is really this influence which comes into play. The well-known case of Dr. Israel[2] is a very instructive

[1] Gerhard: Ueber einige Angioneurosen. Volkmann's klin. Vorträge. Leipzig, 1881.
[2] James Israel: Berliner klin. Wochenschr., 1880, No. 17.

one in this connection. An hysterical patient suffered greatly from ovarian neuralgia accompanied by constant vomiting. All other means having failed, castration was proposed. The patient was chloroformed and a simple incision was made in the skin only, the wound was then dressed daily with much show of care. The patient, who believed she had been castrated, was by this means completely cured of a neuralgia which had tortured her for six years.

Rheinstädter,[1] in his interesting work on female nervousness, insists on the importance of placing young girls inclined to be "nervous" under the influence of some good practical housewife, who will dispel their fantastic ideas, as well as of encouraging them in gymnastics, swimming, and all sorts of bodily exercise.

Diabetes Mellitus.

Of late years this disease has been included within the range of mechano-therapy. The statistics of those who have had most occasion to study it (Seegen, Trousseau, Fleckles, Zimmer, etc.) show that a large percentage of cases occur in corpulent individuals belonging to the richer classes of society, and that an inactive mode of life, affording but little bodily exercise, combined with excesses in diet are favorable predisposing causes. Of 218 cases, Cantani found that 109 were made up of persons retired from business, of priests and of lawyers.

Among the commonest symptoms are muscular weakness and its accompanying fatigue, which Senator[2] refers to the insufficient nourishment which the saccharine blood affords the muscles. Spasms and cramps, especially in the legs, are also of frequent occurrence.

Cantani holds diabetes to be due to a metabolic anomaly, in which both the sugar ingested, and that formed in the body from albumins, is not destroyed as is normally the case, and hence reappears in the urine. All physiologists agree on the muscles being the principal seat of metabolism, and Zimmer[3]

[1] Rheinstädter: Ueber weibliche Nervösität. Volkmann's klin. Vorträge. Leipzig, 1880.

[2] Senator: Article on Diabetes Mellitus in Ziemssen's Cyclopædia.

[3] Zimmer: Die Muskeln eine Quelle, Muskelarbeit ein Heilmittel bei Diabetes. Carlsbad, 1880.

goes so far as to ascribe to the muscles, as well as to the liver, a causative influence in the production of diabetes, especially in the more severe cases. He reasons as follows: Liver and muscle both contain glycogen, a ferment, and water—the three elements necessary for the formation of sugar. The proportion of glycogen and ferment are relatively constant, while that of water is variable. If the amount of water be permanently increased, a continuous formation of sugar in these organs occurs, and diabetes results.

According to Senator, an increase in the amount of sugar in the blood derived from the muscles can only be accounted for by considering the mutual relations existing between the liver and the muscular system, as follows: Where the diabetes is of hepatic origin the liver will be in a state of constant hyperæmia. Active exercise, however, causes a diminution of the amount of blood in all internal organs through determination to the muscles, and the oxidative processes taking place in the latter result in the combustion of much of the sugar contained in the blood. Thus in diabetics who indulge in little or no exercise accumulation of sugar necessarily occurs.

Zimmer claims as another advantage following physical exercise, that well-developed muscles are capable, even when in a state of rest, of disposing of much more sugar than feeble muscles would be, and his observations undoubtedly confirm this assertion, for on a day of rest following several days of exercise, much less sugar was found than formerly, when no exercise at all had been taken.

Long ago Bouchardat affirmed that the sugar diminished, and might even disappear, from the urine after muscular exercise, and Zimmer is quite convinced that persistent exercise, involving all the large muscle groups, is capable of entirely curing hepatogenous diabetes in many cases, and much improving the condition in others.

As only about one case in twenty of hepatogenous diabetes is a so-called grave one—*i. e.*, where the glycogen-forming function of the muscles is affected—it follows that the treatment by exercise becomes all the more important. Zimmer, however, does not omit to warn his readers of being too sanguine of success; all cases not being alike amenable to treat-

ment, because not all muscles are capable of being developed and strengthened. In old, run-down, and anæmic individuals this toning up is naturally more difficult to accomplish than in the young and vigorous. Heart and lung diseases too, are obstacles, inasmuch as any very energetic exercise cannot be indulged in at all.

Zimmer cites cases in which exercise, in the beginning, either remained without effect, or even increased the glycosuria. In these cases some muscular insufficiency must exist, the cause of which it is not always easy to determine. Often, it will be found to depend on an excess of fat in the muscular tissue itself. He mentions the case of a patient weighing 262 pounds, in whom exercise at first caused an increase of the sugar voided, ending, however, in effecting a diminution.

Occasionally it will be found best to defer the use of exercise, or even to abandon its use altogether, or to precede it, or substitute it entirely by mechanical manipulation.

Zimmer mentions the good results of exercise employed in the grave form of the disease, and thinks its effects, on the whole, more lasting than those obtained by diet, as prescribed by Rollo.

As the best effects will ensue when the greatest number of muscles are brought into play, it will be necessary to select such forms of gymnastics as will call into action, equally, all the great muscle-groups. All the various kinds of apparatus mentioned in former chapters should be employed in turn. Riding and fencing are also highly to be recommended.

GROUP IV. MECHANO-THERAPY IN CEREBRAL CONGESTION, HEMORRHOIDS, AND PULMONARY EMPHYSEMA.

The capacity possessed by the muscles of containing considerable quantities of blood when in a state of functional activity, may be utilized to relieve the congestion of internal organs. It is notorious that those engaged in sedentary occupations are liable both to cerebral congestions and to hemorrhoids; conditions which disappear when plenty of daily exercise is indulged in.

Persistent congestion of an organ finally causes venous dila-

tation with atony of the muscular coat of the walls of the vessels; a pathological condition which, once developed, no exercise or any other therapeutic measure is capable of removing.

Pulmonary emphysema can never result from lack of bodily exercise alone (though Rokitansky once assumed it could), but it arises from all such conditions which call for forced expiration. Hence difficulty attending defecation may act as a cause. It is certain that where emphysema preëxists, constipation, with its consequent straining at stool, greatly aggravates the condition. And as muscular inactivity is a direct cause of intestinal inactivity, it follows that emphysematous patients should take daily exercise, either in the form of walks or as well-regulated gymnastics—care being taken to observe a proper moderation, for excess is worse than no exercise at all, since it tends to overtax the lungs which are already in a state of textural degeneration and functionally weakened. Only just enough muscular exercise, therefore, should be employed as will suffice to divert the excess of blood from the overburdened lungs to the muscles.

The pneumatic treatment of emphysema, which consists in making the patient expire in rarefied air, is in effect purely mechanical. The impure residual air is pumped out by this means,[1] diminishing the distention of the alveoli, which are then, at the next inspiration, filled with fresh air.

At the same time capillary circulation is stimulated and the nutrition of the parenchyma improved. By frequent repetition of this process it may, perhaps, be possible to cause a restitution of those portions of the lung which, though abnormally stretched, have not yet begun to degenerate.

Gerhardt recommends as another mechanical mode of treatment, alternate rhythmic compression of thorax and abdomen.

While in emphysema active exercise will always have to be kept within quite limited bounds, much benefit may, on the other hand, be derived from general massage. Patients with cerebral congestion or hemorrhoids will require thorough gymnastics of the whole body. Let them begin with exercises for

[1] No mechanical means suffice to remove the *residual* air, though, no doubt, by the above method much of the *reserve* air can be removed.—TRANS.

the head and neck, following next with those for the arms, trunk, and legs. The latter patients are particularly benefited also by the passive movements to be described under the next group.

GROUP V. MECHANO-THERAPY IN CHRONIC DIGESTIVE DERANGEMENTS AND CONSTIPATION.

These two conditions are almost invariably associated, for if either has existed any length of time, the other is sure to follow. It should be understood that only such derangements are considered here as arise from so-called "abdominal plethora."

Since digestion, absorption, and defecation are all dependent upon nervous influences (coming from the sympathetic, vagus, spinal ganglia, vaso-motor nerves, etc.) which govern the complicated digestive process, it is readily conceivable how even purely psychic influences may affect them.

Digestion, and the subsequent propulsion of the food along the intestinal tract, depend, however, not upon the intrinsic intestinal muscles alone, but upon the varying calibre of the intestinal bloodvessels, and upon the blood pressure as well. Consequently the heart becomes an important determining factor, for when the blood pressure in the intestinal vessels is low, congestion of the portal system, with all its subsequent train of evils, follows. The intestinal circulation, as well as the propulsion of the chyle, is also largely dependent upon the vigor of the respiratory act. Shallow, superficial breathing calls forth but slight diaphragmatic activity, and as the action of the abdominal muscles is reciprocally proportionate to that of the diaphragm and intercostals, it follows that diminished respiratory energy lessens abdominal muscular action. The harmful effects of this inactivity are then superadded to those which have already arisen from diminished flow through the intestinal vessels. The intimate connection which exists between bodily activity on the one hand, and digestion and defecation on the other, is thus readily explained.

Besides this physiological relationship between bodily activity on the one hand, and cardiac and pulmonary on the

other, there is, according to Johannes Müller, still another bond of union. He was of opinion, namely, that activity of the voluntary muscles called forth, in accordance with the law of coördinated movements, contraction of the involuntary muscular fibres as well, and among these, those of the intestinal tract.

Virchow refers portal congestion to two prime causes. First, to disturbed innervation of the muscular coat of the arteries and veins, leading to loss of tone, the elastic fibres gaining the preponderance. In consequence, the vessels become dilated and relaxed, the blood flowing sluggishly, just as any stream flows more slowly when turned into a broader bed. Secondly, to venous congestion from diminished cardiac power. All kinds of digestive difficulties naturally develop from these circulatory disturbances. The distended portal venous radicles lose, to a great extent, their absorptive capabilities, and the lymphatics being unable to meet the increased demands upon them, it follows, as a matter of course, that the food mass remains in the stomach and intestines an abnormal length of time. In consequence of this, all sorts of fermentative changes go on in the mass, the products of which, being absorbed into the blood, give rise to a general disturbance of nutrition. The thus altered contents of the alimentary canal, by irritation of the mucous membrane cause reflexly, also, all kinds of nervous symptoms, such as nausea and vomiting, colic, and cramps, and as the result of chemical changes, eructations, heart-burn, and sour and bitter tastes. The coexisting constipation too, by barring the way for the escape of those gases which are always developed during digestion, gives rise to flatulency and "bloated feeling."

When these conditions have lasted for some time, emaciation, lassitude, and mental depression set in, the latter sometimes ending in melancholia and hypochondria.

Virchow thinks it not impossible that even ulcer of the stomach and nutmeg liver may result from persistent congestion. Certainly, the most frequent causes of these diseases, are sedentary occupations, involving lack of use of the voluntary muscles—especially the respiratory and abdominal.

That the cause of dyspepsia often remains undiscovered

lies in the fact that it may take years before the disease really becomes very troublesome. Patients often will tell you: "I have been accustomed to sit a great deal for years, but I have never been troubled with indigestion until lately."

Occasionally the original source of these troubles is to be sought in some previous disease involving the intestines—as dysentery or typhoid fever—or in cases tending to lower vitality generally, as sexual or alcoholic excesses, immoderate mental work, great emotion, etc.

It must be borne in mind, however, that individuals—especially young ones—exist who are always, from no apparent cause, most obstinately constipated.

When the fecal masses collect until they become so large and dense that the muscles of the intestines are no longer able to propel them along the canal, it becomes the object of mechano-therapy to restore the lost, or at least diminished energy of the muscular coat of the gastric and intestinal portal vessels. This may be accomplished in several ways.

First, vigorous general exercise of the whole body. This stimulates the heart, increases the general blood pressure in all the vessels, and causes an increase in strength and tone in the vascular muscular coat, which like all muscles follows the law that muscular power grows in proportion to the demands made upon it. According to Du Bois-Raymond ustriped muscle fibres become stronger by exercise, and pathological experience with the bladder, etc., confirms this. Rosenthal's supposition that immunity conferred against catching cold by the use of cold baths depends on exercise of the unstriped muscle fibres of the skin and its vessels rests consequently upon, at least a certain empirical foundation, for Du Bois-Raymond says: "Cold washing and bathing are gymnastics for the cutaneous muscles."

Secondly: Special exercises for the abdominal and thoracic muscles.

By these the organs contained in the respective cavities can be roused from their habitual torpor and be made to recive a salutary shaking up. Deep vigorous respirations increase the activity of diaphragm and abdomen, and by thus causing rhythmic alternations of intra-abdominal pressure, lead to in-

creased rapidity of circulation throughout the whole portal system. In consequence, the muscular power of the portal vessels is increased and the blood pressure raised. The normal conditions of pressure being thus reëstablished propulsion of chyle and feces is resumed, the muscles of the intestines gradually regain their lost powers and, finally, all the functions are again restored to normal.

The following exercises are recommended:

A. Exercises without Apparatus.

1. Body-bending—forward (Fig. 90), backward (Fig. 91), right, left—aid being given by the assistant when necessary.

Fig. 90.

Fig 91.

All the exercises are to be repeated ten to twenty times, according to the number of different ones employed each time.

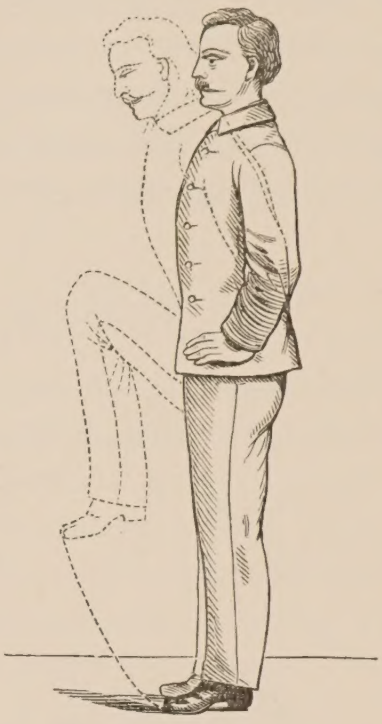
2. Body-circling—is a combination of the four above. The assistant should stand in front of the patient, guiding the circling motion of the trunk—which describes a cone whose apex is at the sacrum. The feet should be close together and the hands on the hips (Fig. 92).

3. The knee-lift. The body being bent slightly forward, the knees are to be sharply raised till they touch the chest (ten times with each). Fig. 93.

4. Horizontal arm motion (Fig. 94)—backward and forward. The body being bent backward when the arms are brought

FIG. 92.

FIG. 93.



forward, and forward as the arms go back; thus bringing the abdomen into action. It should be done both with and without dumbbells.

FIG. 94.

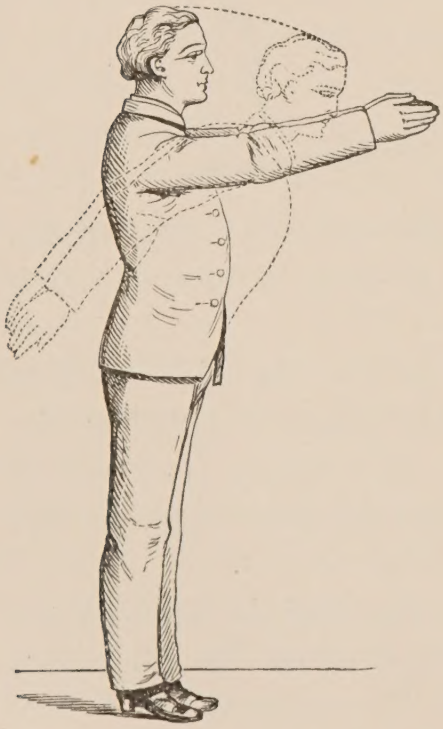
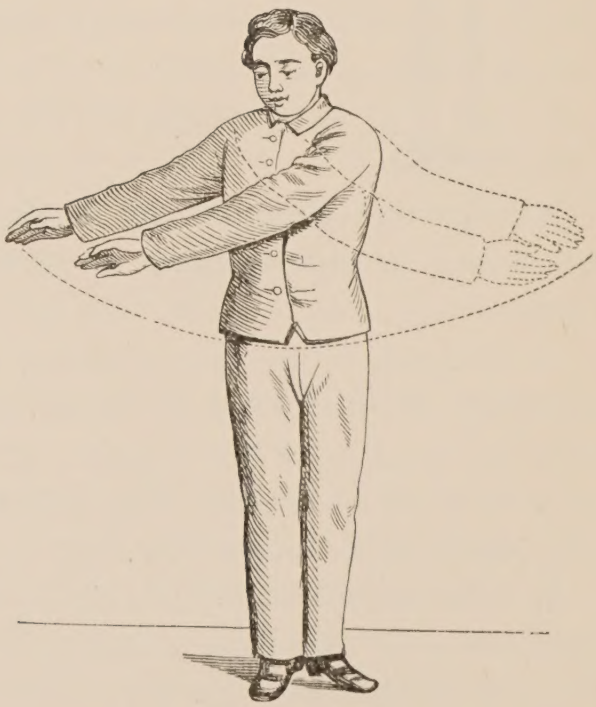


FIG. 95.



5. Arm motion from side to side (Fig. 95)—the body being bent slightly forward and participating in the movements (with and without dumbbells).

FIG. 96.

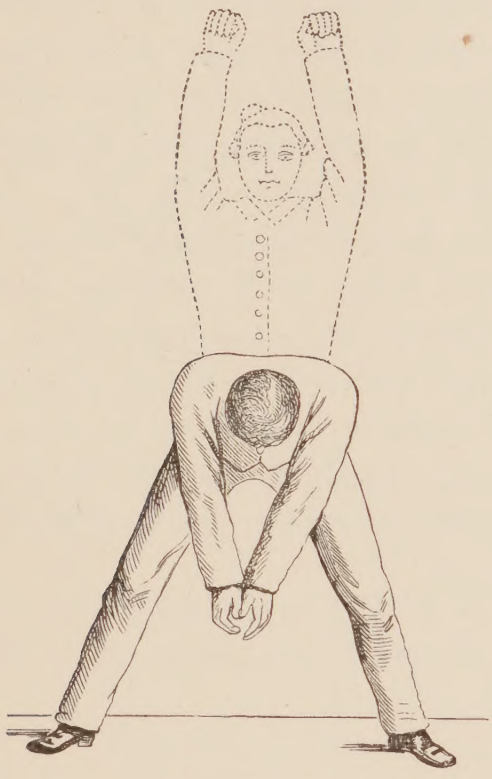


FIG. 97.

6. Hewing (Fig. 96). The patient, standing with legs apart and toes turned out, raises his extended arms above his head

FIG. 98.

and then bends the whole body forward and downward as though splitting a piece of wood at his feet with an axe. The hand should pass between the legs (with and without dumb-bells).

7. Sawing (Fig. 97). The body being bent well forward, each arm alternately makes movements as though using a saw.

8. Step-changing—with alternate rotation of the trunk. This movement, which is difficult to describe, will, however, at once become clear on referring to the figure (Fig. 98).

9. The lunge—with backward and forward movement of the trunk (Fig. 99). The patient steps with one leg as far forward as possible, bending the knee, the other leg remaining extended. The body is then bent forward as far as possible, and kept so for twenty seconds, when it is thrown backward, the bent leg at the same time being extended, and the straight being bent. This is to be repeated five times before changing sides.

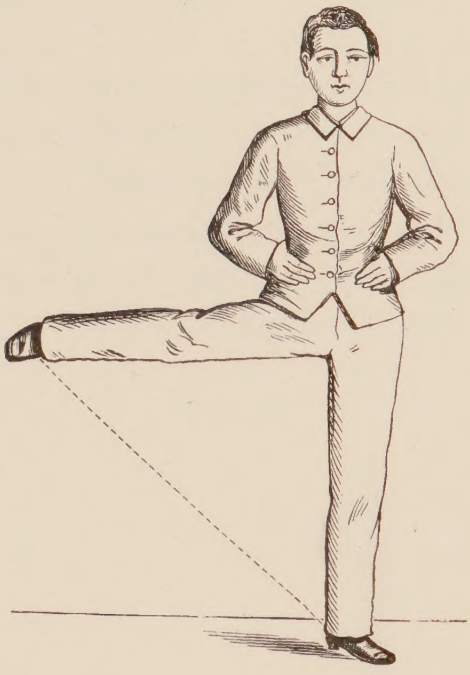
FIG. 99.

FIG. 100

10. Squatting (Fig. 100). Hands on hips, heels together, toes out, then sudden squatting motion, remaining in this position about ten seconds, when the erect position should be recovered with a spring. This movement must be performed quickly.

FIG. 101.

FIG. 102.



11. The leg-lift—forward. (Fig. 101.)
12. The leg-lift—backward. (Fig. 102.)

FIG. 103.

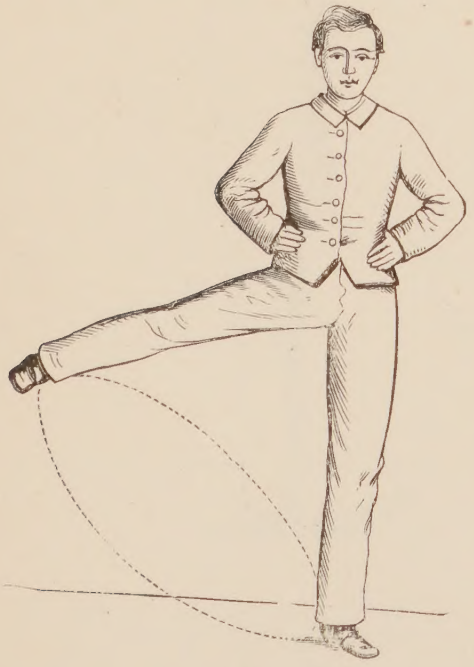
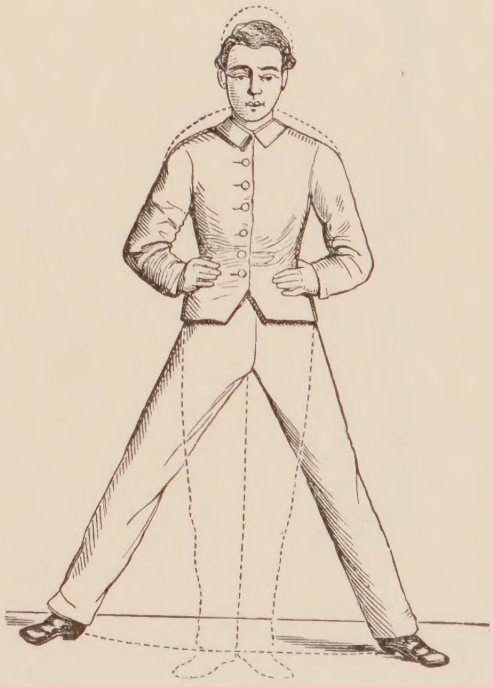


FIG. 104.



13. Leg-circling. (Fig. 103.)
14. Springing from toes—the heels being alternately near together and far apart. (Fig. 104.)

B. Exercises with Apparatus.

I assume that treatment is to be pursued at home, and confine myself, therefore, to mentioning such simple apparatus as can readily be erected in any private dwelling.

For extension of the body a detachable horizontal bar can be put up between the jambs of a door, or hanging rings may be suspended from a couple of stout hooks let into a

Fig. 105.

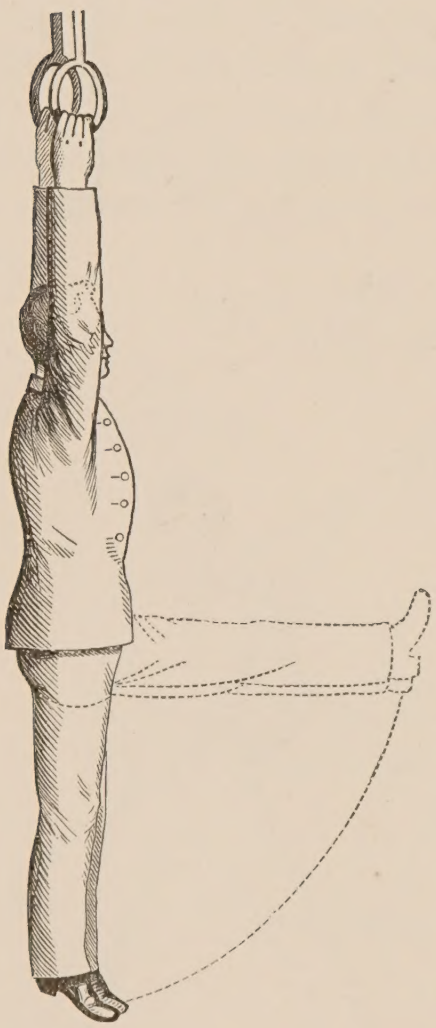
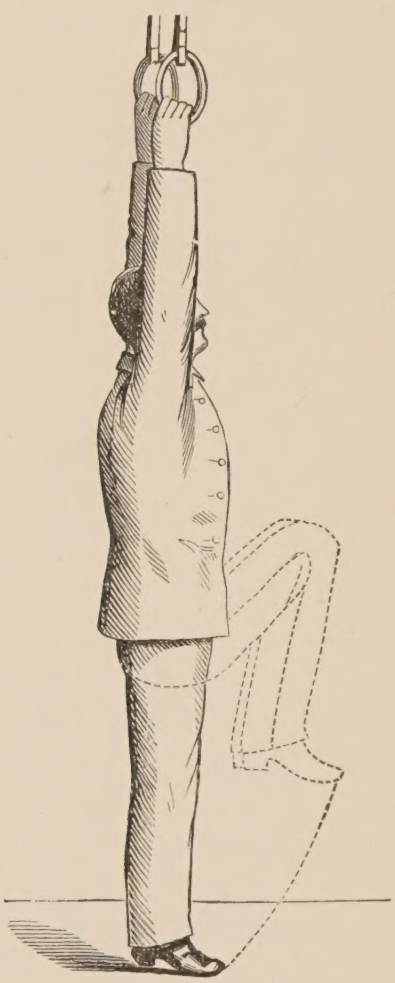


Fig. 106.



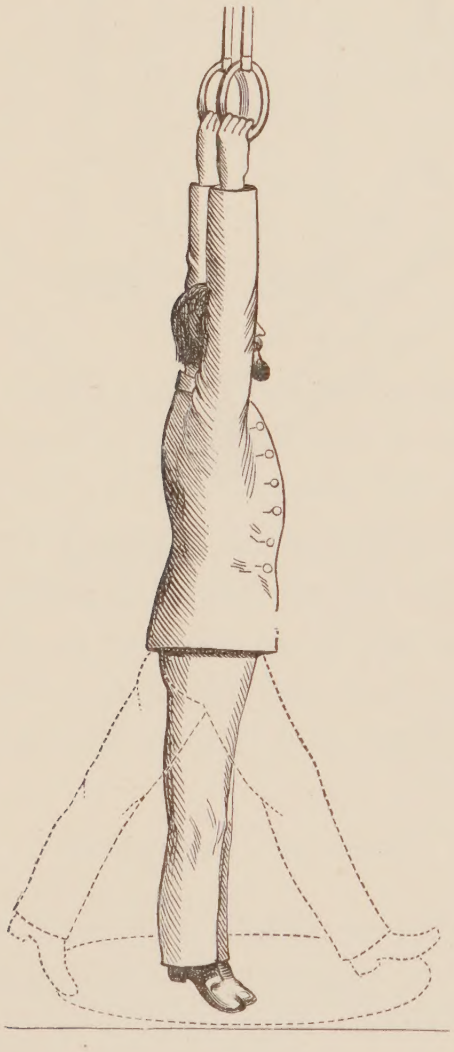
beam in the ceiling.[1] The rings have the advantage over the bar, that they can be used for exercises for which the latter is not suitable. They should have straps and buckles by which they can be made higher or lower.

[1] As all dealers in sporting goods keep this kind of apparatus, a detailed description seems superfluous for American readers.—Trans.

1. The hanging leg-lift (Fig. 105). The rings should be just low enough to be grasped on tip-toe. Then, hanging by the arms the extended legs are to be raised to as nearly a horizontal position as strength will allow,[1] and then allowed to sink again. This must be repeated ten times.

2. The hanging leg-kick (Fig. 106). The patient hanging from the rings as above, draws both knees to the chest and then gives a sudden downward kick, extending the thighs at the hips. To be repeated ten times, with a rest in between.

FIG. 107.



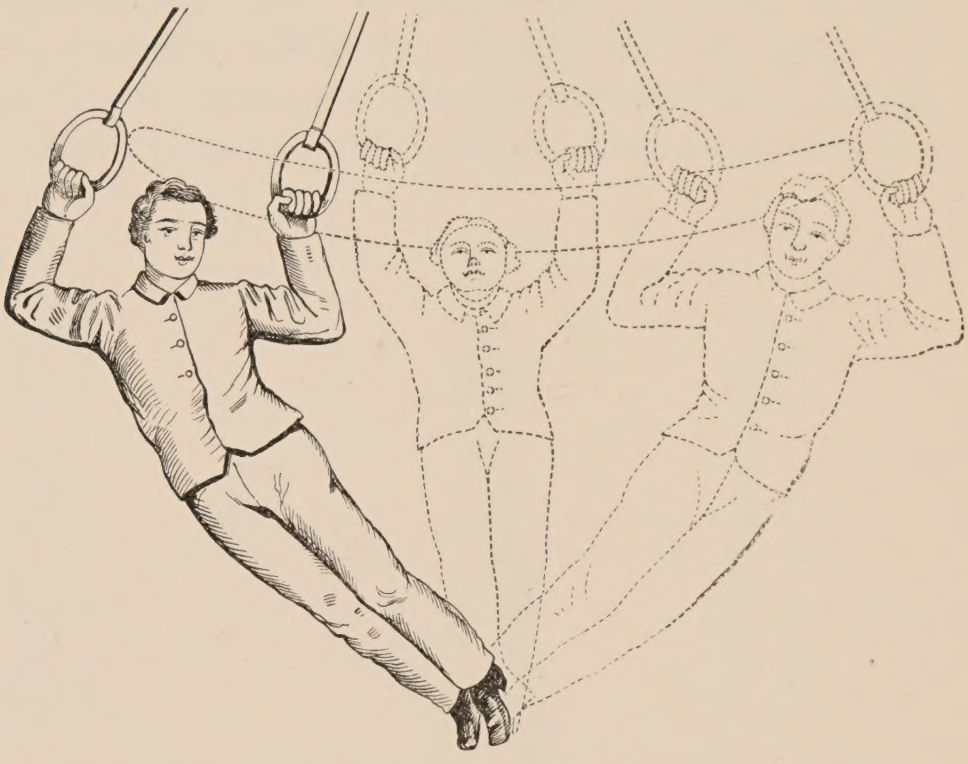
3. The hanging leg-circling (Fig. 107)—is analogous to body-circling. While hanging the legs are circled first to the right and then to the left—each ten times. This movement is some-

[1] Simple as this exercise seems, it requires great strength—such as few possess—to raise the extended legs until they form a right angle with the body, and to *keep them so*.—TRANS.

what difficult, as the trunk easily participates in it. This, however, should be prevented.

4. The funnel (Fig. 108). The rings are lowered as far as the breast, the patient then grasps them, extends the arms, so

Fig. 108.



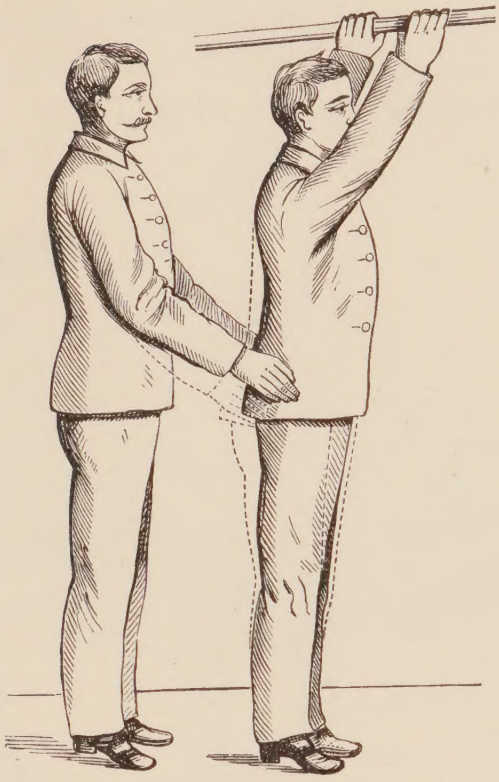
as to lower the body backward, keeping his feet at the same time just beneath the rings. Then by flexion of alternate arms the body may be so set in motion as to describe a funnel or cone, of which the feet are the apex. This should be performed first to the right and then to the left.

Passive Movements.

While many different kinds of passive exercises are commonly performed in movement-cure establishments, the following will amply suffice for all purposes.

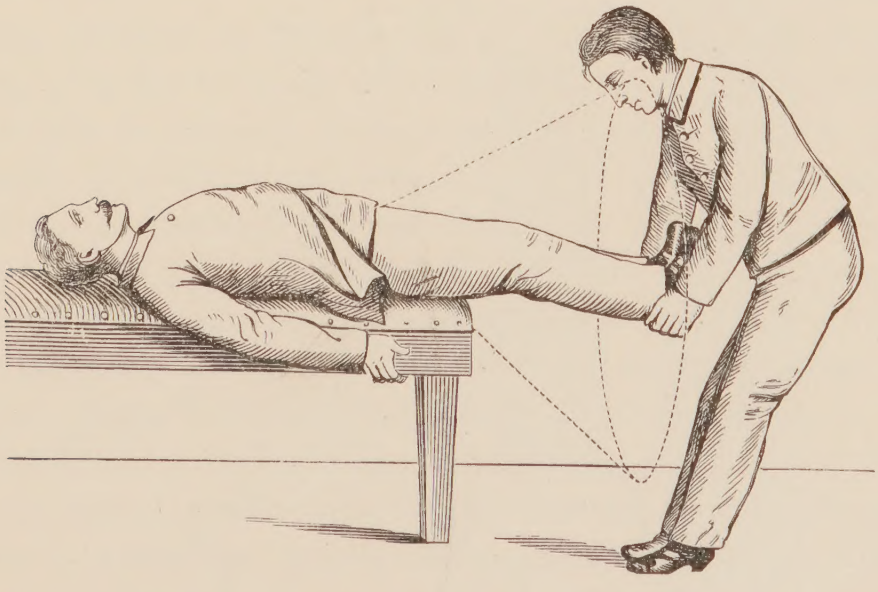
1. Rotation of hips. (Fig. 109.) The patient steadies himself by the bar with both hands, while the manipulator, who stands behind, firmly grasping each hip, rapidly turns the pelvis from side to side. The patient must, of course, relax the pelvic muscles. This should be done twenty times, and then repeated after a short rest.

FIG. 109.



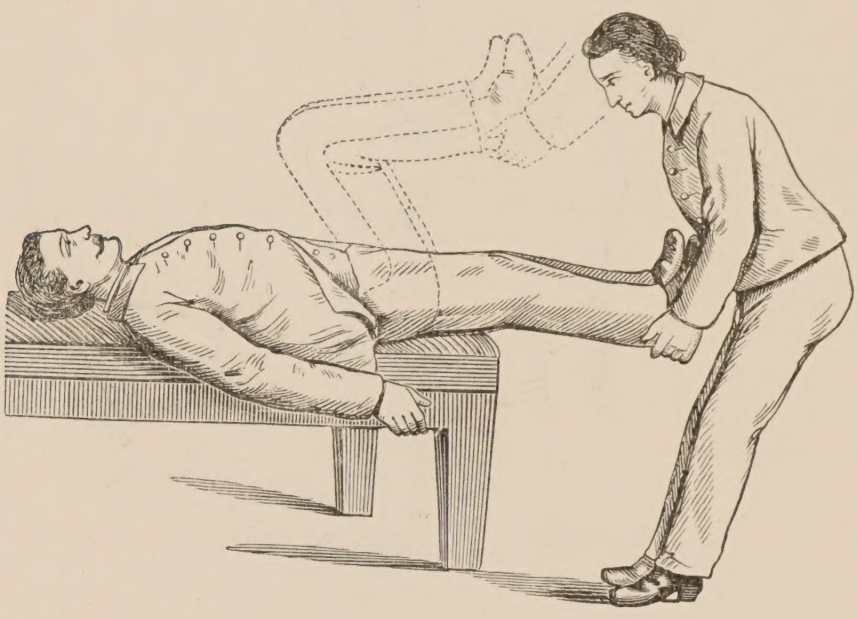
2. Rotation of the thigh. The patient lies flat on the bench, in such a manner as to allow the lower extremities, from the trochanters down, to project beyond the end. The attendant seizing each extended leg by the ankle, circles it round and round, first ten times to the right, then as many times to the left. (Fig. 110.)

FIG. 110.



3. The knee-chest flexion. The patient lying as before, the attendant seizes both heels and forcibly flexes the thighs upon the body, until the knees touch the chest. The thighs are then forcibly extended again. (Fig. 111.)

Fig. 111.



Chronic constipation offers the most signal successes to mechano-therapy, for it is possible to make direct mechanical pressure upon the cœliac and hypogastric plexuses and through these to reflexly excite peristalsis; furthermore, the vasomotor nerves and the intestinal muscular fibres are directly stimulated by the pinching and squeezing to which they can be subjected.

The cœliac plexus and its ganglia, since they lie upon the anterior aspect of the aorta, may be easily reached by pressing deeply midway between the xiphoid process of the sternum and the umbilicus. The hypogastric ganglia and plexus are reached by making pressure midway between the umbilicus and symphysis pubis. The finger tips should be used in both instances, the patient half lying, half sitting upon the bench, with knees elevated to relax the abdominal muscles. (Fig. 112.) I prefer to manipulate, not only the areas just mentioned, but the whole abdomen as well, first transversely, then longitudinally. After this procedure—which should be carried out with a peculiar rotatory thrusting movement—has been gone through twenty or thirty times, I grasp the upper por-

tions of the ascending and descending colons between thumb and fingers of either hand and subject them to a vigorous

FIG. 112.

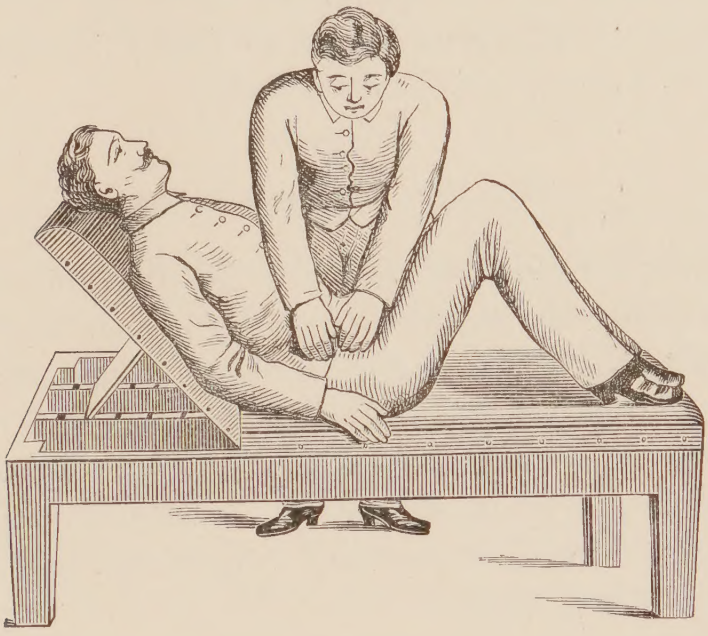
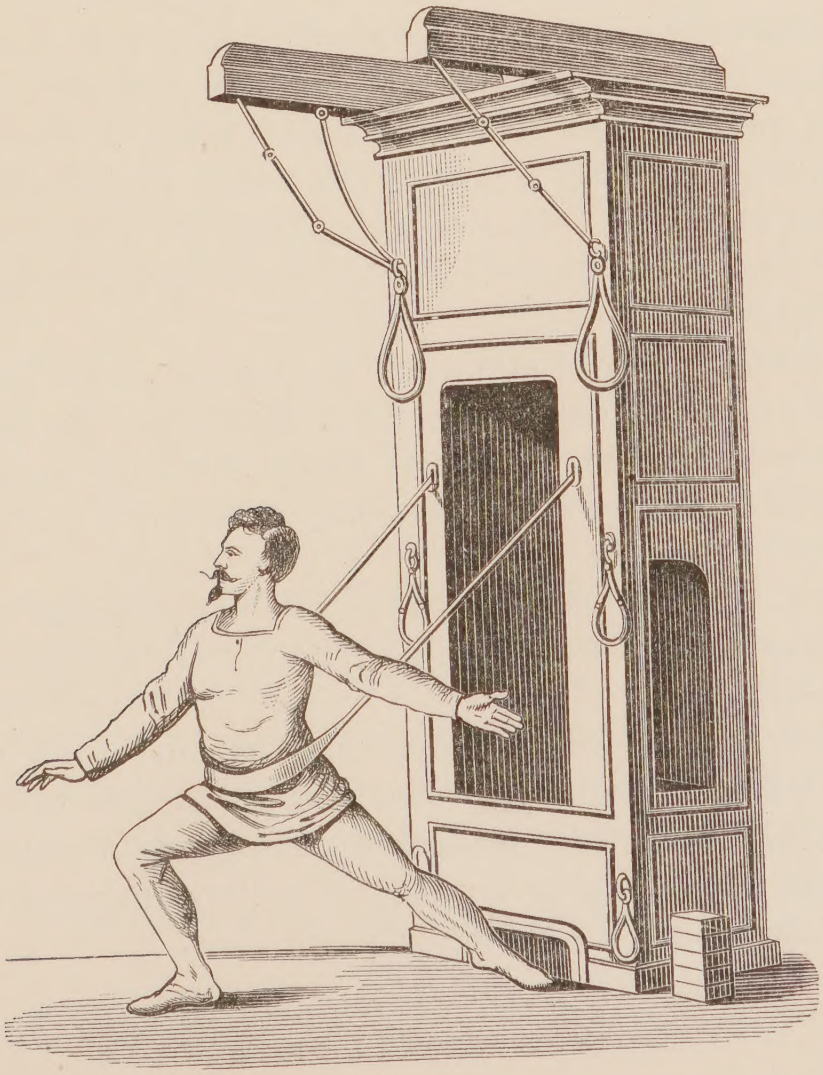


FIG. 113.



pinching and kneading. Finally, I make firm pressure in the inguinal regions in order to reach the caput coli and cæcum on the one side, and the rectum on the other.

For strengthening the abdominal muscles there is nothing better than the apparatus shown in Fig. 113, resistance being increased from time to time by weights.

General Observations.

It is perhaps hardly necessary to say that mechanical treatment must always be supplemented by proper diet.

Every now and then we come across young persons—generally girls—who, while otherwise healthy, suffer from obstinate constipation. The fecal masses are so large that their passage through the intestinal canal tries the elasticity of the muscular fibres to their utmost, the rectum, especially, being in a constant state of distention.

I have repeatedly seen in these cases—where formerly a movement could only be obtained by drugs—a few weeks of mechanical treatment bring about defecation immediately after the manipulations. The duration of treatment will often have to last from four to twelve weeks, hence it would not be justifiable to give up a case if after, say, six weeks no cure had been obtained. On the other hand, there are patients—happily rare exceptions—in whom a most careful three months' course produces no results.

A recital of cases would be of no interest, since they are all as much alike as two peas, and I only give the one below simply to show that in some cases mechano-therapy may prove a last resource when all means have failed.

Case X.—H. von B., aged fifty-four, had suffered for years from constipation, so that a movement was not possible unassisted by drugs.

After trying all sorts of remedies, he finally resorted to a dietetic cure at Wiel's establishment in Zurich, but without success. He was then treated by me for four weeks, with such good results that he now enjoys a daily natural movement without the use of medicines.

GROUP VI. MECHANO-THERAPY OF CHOREA AND WRITER'S CRAMP.

However familiar the symptoms of these two affections may be to us, their pathological anatomy is still involved in obscurity.

Chorea.

Ziemssen[1] agrees with Charcot in placing the seat of this disease in the cerebral hemispheres, and more especially in the basal ganglia, while others (Bert, Onimus, Chauveau, etc.) refer it to the cord, and almost as much diversity of opinion exists about the nature of the excitant as there is regarding its location. Some look upon embolism in the corpus striatum or thalamus as the cause, while the cases following sudden emotion—as fright—have been referred to disturbances of cerebral nutrition resulting from vasomotor disturbances secondary to the psychic shock.

It has heretofore been customary to regard general toning up of the organism by fresh air and proper food, induction of sound sleep, and careful and tender physical and moral supervision as merely secondary to all other forms of treatment. Let us, however, look a little more closely into mechanical treatment.

Some regard it only as adjuvant, while others are inclined to give to it a major importance. Thus, Ziemssen recommends it only during the decline of the disease, using it to stimulate the will by fixing the attention upon the exercises to be executed. He assumes, as a matter of course, that no one would think of treating a chorea, symptomatic of cerebral or spinal disease, by gymnastics. Yet the purely mechanical treatment of chorea is by no means a new idea.

In 1847, trials had already been made in Paris in the Hôpital des Enfants Malades, and up to July 22, 1851, ninety-five cases which had resisted all other forms of treatment, were recorded as cured by methodic exercise. In that year, too, Dr. Blache addressed an assembly composed of the directors of the As-

[1] Ziemssen's article on Chorea, iu Ziemssen's Cyclopædia

sistance Publique, as well as many prominent physicians, upon the results of this new method, executed under his orders by the then celerated masseur Napoleon Laisné. Only a short time before, Dr. Sée had published an article, which received a prize from the Académie des Sciences, in which he placed gymnastics in the very front rank of therapeutic measures. Blache closed his report by saying that in four years not one of the choreic children treated by gymnastics had suffered a relapse.

Laisné, who was not a physician, but Professor of Gymnastics at the Collége Louis le Grand, in his work on the subject,[1] cites a large number of valuable observations made by himself in the treatment of chorea, and also describes his own methods.

It is difficult, he says, to give at the outset a prognosis regarding duration of treatment, for grave cases often get well quickly, while seemingly mild forms may run a protracted course in spite of everything. From his wide experience he was able to affirm that spoiled, cross, or very nervous children are more difficult to cure than amiable and sensibly educated ones. Where the disease was consequent on onanism, he looked upon it as next to incurable.

In mild cases, simple, rhythmic exercises usually suffice. Laisné proceeded as follows: He placed the child before him, steadying it between his knees, then took its hands in his and performed rhythmic movements with each arm, keeping time by counting—or better *singing*—out loud, "one," "two," "three," etc.; the child, at the same time, being urged to try to keep time also with the movements, and not to make them irregularly. Care must be taken to prevent, in the beginning, as much as possible, the coincidence of involuntary movements with rhythmic ones.

When the arms have been exercised, similar movements are undertaken with the legs.

From time to time a pause for rest is made, during which the limbs must be held firmly enough to prevent the occurrence of involuntary motions. The child is then laid on its

[1] N. Laisné: Applications de la Gymnastique à la guerison de quelques maladies. Paris, 1865.

back upon an inclined ladder, the feet being held by an assistant; then, grasping a rung above its head, it holds on in that position as long as it is able. This is to be repeated several times, and to be followed by a short rest. Afterward, the shoulders, back, and legs are rubbed and gently kneaded. Care must be taken not to demand too much will power of the child in the beginning, for if the limit be overstepped, not only instead of soothing effects, do we get increased excitability, but all the progress made may suddenly be lost. Another mistake frequently made is to allow the child to walk too much, nor is it well to let it indulge in the romping games of other children. Choreic children should not be constantly reproved for their incoördinate movements. On the contrary, should they involuntarily let something drop from their hands they must be kindly soothed and encouraged. Care must be taken, too, that they do not cut, or bruise, or otherwise injure themselves.

As improvement progresses and the child becomes able to perform movements by word of command, new exercises, in which the child's own free will alone comes into play, must be added, such as exercises on the horizontal ladder, and on the single and parallel bars. As soon as a certain degree of control has thus been obtained, exercise in company with its companions may be allowed, and thus, gradually, a complete cure will have been effected without any further special treatment.

All that has been said above pertains to treatment carried out in children's hospitals, where there is good discipline, and where the exercises are under the supervision of a physician.

In private cases treatment is more difficult. We have to contend with the family, too often lacking in the necessary appreciation of the situation. The poor child is often treated impatiently and scolded, no matter how hard it may try—usages which only contribute, of course, to protract the disease.

The very best of choreic children are usually wilful and obstinate; still they must not be indulged too much, since that also only tends to make them worse. It must not be forgotten, either, that great cleanliness, fresh air, good food, and some form of quiet diversion are indispensable necessities for these little patients.

In severe cases the exercises must be undertaken twice daily, and great care and judgment must be observed in their execution. At all times careful watching is necessary to prevent bodily injury. It may even be necessary, in extreme cases, to fasten the limbs with bandages in bed, to prevent the child hurting itself either by involuntary blows, or by falling out of bed.

In the severest form it is best to wait before beginning gymnastics, until the conditions for treatment become more favorable.

For a child unable to either talk or walk an attendant—some one familiar with its ways and wants—is indispensable; because, as soon as such a child finds that it cannot express itself, it screams and cries, and the more it wants a thing the louder it screams. In cases like these it is really a question of divining the child's wishes from its looks. Though we may ask the child all sorts of questions, it only stares at us in reply; but if the object wanted is not soon found the screaming and gesticulations begin anew. In vain all kinds of playthings are offered it, and every attempt at quieting it proves useless.

If it is to be fed, it is put upon a chair, one person holding the body and arms, another holding the head, while a third must be ready to pop in the food as soon as the mouth is opened. The same process is gone through for drinking; a cup is held to the child's mouth, and, whenever opportunity offers, enough for one small swallow is poured in; for these patients are seldom able to make several consecutive swallowing movements.

Often, indeed, the contents of the mouth will be forcibly ejected, but we must never be disheartened from making renewed attempts. All dishes used for the child should be of tin, so that it may not injure itself by broken glass or crockery. It will be found best to nourish the child with fluid food, letting it suck it up by a flexible tube, when able to do so.

As the result of numerous observations, Laisné arrived at the following conclusions:

1. None of the means hitherto employed against chorea can show such uniform success as gymnastics.

2. The mechanical treatment is applicable to almost all cases, whereas, the medicinal very frequently is not.

3. The improvement begins as soon as when sulphur baths are used, while the sedative action usually manifests itself within a few days.

4. With the arrest of incoördinate movements, the general health of the child markedly improves, so that not only the chorea, but the accompanying anæmia is cured as well.

The use of exercises in the beginning might seem to be rather hazardous, but in reality it is not so. He insists that only passive motion should be used so long as the patient is unable to control his muscles.

It may be of interest to mention here, that a young lady, Mademoiselle Clémentine Lebègue, who was herself cured of chorea by gymnastics, was made professor of gymnastics at the Hôpital Sainte-Eugenie (now Hôpital Trousseau), and by her intelligence, patience, and perseverance, has earned the recognition and esteem of the whole medical staff.

There is indeed no reason why treatment can not be carried out by any intelligent lay person after receiving instruction from a physician. The mechanical treatment of chorea exemplifies, perhaps, better than anything else DuBois-Reymond's dictum, that "muscular exercise is not exercise of the muscles alone, but exercise of the brain as well."

Laisné was able to cure cases of chorea whose most prominent symptom had been attacks—occurring often during a period of years—of spasmodic and most exhausting cough.

In his report Blache[1] attaches the highest importance to passive motion for such children as are too choreic to go through the regular exercises with the other children. These motions should even be performed in bed, if necessary.

Treatment of Writer's Cramp.

Between chorea and writer's cramp there exists not only an anatomical and genetic difference, but also a symptomatic one; in fact, the only similarity between the two lies in the existence

[1] Blache: Du traitement de la chorée par le gymnastique. Rapport lu à l'académie de médecine le 10 avril, 1855.

in both of involuntary, spasmodic muscular contractions. In chorea, contractions occur independently of time or circumstance, or muscle group, or willed action; while in writer's cramp and its analogues (piano-player's, tailor's, shoemaker's, and milker's cramps), involuntary contractions occur only when certain acts are attempted, and then only in the muscle groups involved in this particular action; and, as a rule, also, only after the muscles have been working normally for some time.

Chorea is usually a disorder of the juvenile brain, and is often associated with other disturbances of central origin both constitutional and hereditary. Writer's cramp, on the other hand, is the almost invariable result of over-exertion in adults of the muscles involved, and arises either from inability of the muscles to respond to the work required of them, or from some faulty way of holding the pen.

Various opinions regarding the seat and nature of the lesion exist, all of which, however, lack positive data. One thing though, is certain, namely, that the condition included under the general term of writer's cramp is dependent on a number of different pathological conditions. Benedikt has established three types, differing from one another symptomatically, a classification to which Erb, in view of our present ignorance of the true causes, gives his support.

Benedikt distinguishes namely, a spastic, a tremoral, and a paralytic form. All these three forms have this common characteristic, that not only in writing, but in any occupation involving the use of the fingers (as sewing, piano- and violin-playing, milking, hammering, etc.) the muscles used refuse after a while to do the required work, and disturbances occur, manifesting themselves chiefly in the form of fatigue, which render the occupation either difficult, or wholly impossible.

Benedikt called this form of disturbance a "coördinative neurosis of occupation," because in most cases the coördinating powers are interfered with.

In the act of writing a large number of rapid but harmoniously regulated movements, occurring both simultaneously and consecutively, must be performed by the small digital muscles (lumbricales and interossei), by the flexors and exten-

sors of the fingers and especially of the thumb, and by the muscles of the arm and forearm. As is well known, the association of these numerous movements is only learned in the course of years and after endless repetition, till finally the act takes place almost without conscious effort.

According to Erb, it would seem as though the different volitional impulses necessary for the separate movements of the fingers and hand are most probably collected in certain cerebral areas called coördinating centres; that the tracts leading from these centres—coördinating tracts—are, however, to a certain extent at least, independent of the tracts conducting simple—non-complicated—volitional motor impulses. It follows, therefore, that the slightest disturbance in any of the tracts necessarily reacts upon the whole apparatus.

If increased excitability and conductivity exist in certain tracts—the volitional impulse remaining the while unchanged—we get a condition of cramp in the involved muscles. If, on the contrary, resistance be anywhere increased, we get paresis in the muscles supplied by the affected tracts, while at the same time spasm of the coördinated muscles will occur as a result of an increased volition which seeks to be compensatory.

Peripheral lesions of the muscles or nerves may also cause a disturbance of associated movements, showing itself either in the paretic or spasmodic form.

The three forms of the disease established by Benedikt correspond to the most prominent group of symptoms in each.

In the spastic form, which is the commonest, tonic or clonic spasms occur either in single muscles or in groups, after writing a short time. The thumb and index finger are most frequently affected; either the pen is dropped from the hand on account of the sudden extension of the fingers, or by the spasmodic flexion of the thumb and index finger (which at the same time is generally abducted), it is suddenly lifted from the table. Occasionally we meet with spasmodic pronation or supination of the forearm, so that the pen may be either raised from the paper, or pushed aimlessly back and forth. Still more rarely are the muscles of the shoulder affected.

The tremoral variety is characterized by a shaking of the

hand and forearm, rendering the writing irregular and illegible.

In the paralytic form the cramps are replaced by a feeling of fatigue and weakness amounting practically to paresis. The hand is as though dead, and is, at the same time, the seat of painful sensations which radiate to the arm, shoulder, and even back, after the manner of true neuralgia. At the same time other acts, of a coarser kind, can usually be perfectly well performed. In addition to the pains, there is sometimes a feeling of formication and numbness in certain areas on the arm and forearm. All the varieties of writer's cramp are made worse by any mental emotion or excitement, or by mental and physical overwork.

The prime cause of the disease is continuous and fatiguing writing. In rare instances, however, it occurs in those who write but little. A faulty manner of holding the pen, as well as pointed or hard pens, certainly contributes to its causation. Indeed, it has been said that it owes its existence to the introduction of steel pens, but this is undoubtedly an error, for reports of cases exist, dating back to the time when only quills were used.

From all we know of the nature of the disease we must be inclined to assume with Erb, that (in typical cases) it depends upon a disturbance of nutrition of the central nervous system, situated either in the cervical cord, in the peduncles, or in the cortex.

Nearly all authors agree that the different forms of treatment are alike unsuccessful; certainly a complete cure is a rarity, though improvement often takes place. In many cases, however, the disease becomes so aggravated in the course of time that writing has finally to be abandoned altogether. No matter what the form of treatment—whether by electricity, by hydrotherapy, by gymnastics, by baths, by narcotic or alcoholic applications, or by mechanical influences—one condition has always been demanded, namely, that during treatment all attempts to write should be absolutely abandoned. Recently, Nussbaum, however, has ventured to combat this universally accepted opinion. In an article[1] published in 1882 he directs

[1] Von Nussbaum: A Simple and Successful Treatment of Writer's Cramp. Aerztliches Intelligenzblatt, No. 39, 1882.

his patients to write as much as possible with the instrument figured and described below, which compels the wearer to use his muscles in a way diametrically opposite to that he has always practised. He says to his patients: "Write much with this apparatus, for the more you write, the sooner you will be cured and be able to hold the pen in the common way again." The celebrated Munich surgeon is of opinion that

FIG. 114.

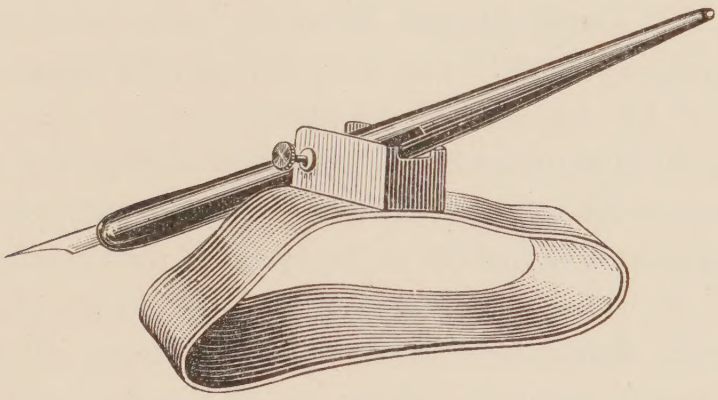
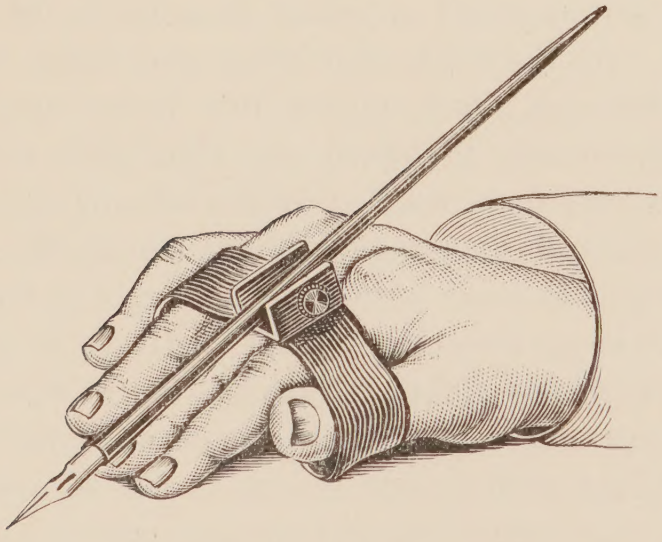


FIG. 115.



overexertion of the flexors and adductors—these being the muscles chiefly used—is the cause of the cramps, and that the condition may be cured by using the extensors and abductors instead. To this end he has constructed the apparatus shown in Fig. 114.[1] It consists of a thin, oval band of hard rubber about two centimetres broad, suitably curved for slipping over

[1] Made under Nussbaum's directions by Gebrueder Stiefenhofer in Munich. In ordering, the natural breadth of the hand should be given.

the thumb and all the fingers but the little one, which remains outside. By means of a clamp a penholder can be conveniently adjusted. The long diameter of the oval being made purposely somewhat longer than the breadth occupied by the fingers over which it is to go, the fingers will have to be spread apart—the thumb being drawn to the left, the fingers to the right—in order to keep it from falling off. Muscles are thus forced into use which are the exact antagonizers of those normally used, and at the same time, the act of writing is transferred from the fingers to the whole hand, and motor impulses formerly sent to the flexors and adductors now being transferred to the extensors and abductors.

It is claimed that with this apparatus sufferers from writer's cramp are not only enabled to write continuously, but that, by and by, they can discard it entirely and write with a pen as before, the increased power which has been given to the extensors and abductors by exercise sufficing to completely antagonize any spasmodic action in the flexors and adductors.

As yet, the number of cases treated with this ingenious contrivance is too small to serve as a basis for any definite conclusions. It is said that anyone can learn to write well with his extensors, after only a few hours' practice. From personal experience, I should say that this statement may perhaps hold true for a few. For the sake of experiment, and not for any therapeutic reasons, I have repeatedly written with this apparatus for some time together, and I must own that while my writing may have been distinct, it was certainly neither beautiful nor fluent. I do not doubt that after several weeks' practice one might perhaps learn to write quite well and even rapidly with it, but not in a few hours. As might be expected, the individual strokes are coarse and uncertain. To keep on the line is a still more difficult task.

It is natural, however, that a person, formerly unable to write even his name without getting cramped, would be highly delighted at being able to finish a couple of pages with Nussbaum's apparatus.

Nussbaum, though considering it alone sufficient to effect a cure, holds that massage of the hand and arm as well as baths and faradization, act as useful adjuvants.

He formulates his observations as follows:

1. Every patient, who formerly was unable to even scratch down his name, let alone write a couple of lines, could, to his great surprise, write two pages at once and without fatigue, with the apparatus.

2. No cramps ever occurred while using it.

3. All agreed when using it that those parts of the hand which were formerly the most painful, felt now even more comfortable than normal.

4. After using the apparatus diligently for some time a few patients felt intuitively that they were again able to use the pen in the old way.

5. In treating this disease it simply stands to reason that the cramped muscles must be thrown out of use, while their antagonizers must be strengthened by gymnastics. This end the apparatus fully accomplishes.

Assuming that the theory of a paresis of the antagonizers is correct, the end to be attained by mechanical treatment becomes self-evident. The problem consists in seeking to strengthen these paretic muscles in every possible way. Nussbaum's apparatus fulfils this indication in every respect, and a better method of calling into action abductors and extensors it would be hard to conceive.

My own experience with writer's cramp embraces but two cases, which I have followed for a number of years with much interest. A summary of them will be given below.

In the so-called paralytic [paretic] form of the disease in which there are no cramps, but only a weak, tired feeling in hand and forearm, every form of exercise may be used to advantage—pressing, kneading, and hacking the muscles of the forearm and thumb, and volar aspect of the hand—as well as employing passive and active movements. To affect the interossei and lumbricales, grasp the patient's hand in both your own—he being seated opposite—first press the metacarpal bones up and down and then draw them apart, repeating the operation many times. Another good passive exercise consists in grasping either edge of the patient's hand and depressing the edges while raising the centre. After repeating this a number of times the reverse motion should be made. In this

way these otherwise inaccessible muscles are rubbed against one another, and their nerves stretched and otherwise subjected to molecular changes. Even electricity is scarcely able to reach them, situated so deeply and covered by thick skin and fat, as they are.[1]

According to Haupt, abduction and adduction are principally carried out by the interosseous muscles—seven in all—which are so arranged that each finger has two, the little finger excepted, which has but one palmar, abduction being performed in this instance by the abductor digiti minimi.[2] When a single interosseous contracts, the first phalanx to which it belongs will be drawn toward the same side as the muscle, producing consequently either abduction or adduction.

Two muscles acting simultaneously upon the same finger cause flexion, since their tendons are inserted conjointly into the dorsum of the phalanx, and at the same time into the tendon of the extensor communis digitorum. By rendering the extensor communis digitorum tendon tense they allow the latter to extend the second and third phalanges.

Duchenne explains this seeming paradoxical action by assuming that the interossei cause two diametrically opposite actions —flexion of the first and extension of the last two phalanges, an occurrence hitherto unknown in anatomy. Haupt's demonstration, however, entirely clears up this apparent contradiction.[3]

Below will be found an account of the two cases mentioned as having been under my observation. They present such differences that one is forced to the belief that widely differing pathological conditions must have underlain each, the only apparent connecting link between them being the common symptom of disability for the act of writing.

CASE XI.—Baron d. B., Royal Commissioner of Forests, forty-four years of age, of excellent constitution, and cheerful

[1] With proper electrodes their electric stimulation presents no difficulties —TRANS.

[2] For an excellent account of this subject see a paper On the Anatomy and Physiology of the Small Muscles of the hand, by Clovis Adam, M.D. Archives of Medicine (Seguin's), February, 1883. —TRANS.

[3] The author certainly labors under a misapprehension regarding Duchenne, who has quite clearly shown how the interossei cause both flexion and extension. See his "Physiologie des Mouvements," Paris, 1867.—TRANS.

temperament. He began to notice the first symptoms of his trouble in 1872, but attached no importance to them at the time. During the past five years has experienced a sensation of heaviness and clumsiness in his hand, especially when making the shaded downstrokes of letters, like *m*, *n*, *t*, and *f*, which run from right to left and from above downward. In making the German *s* his hand is involuntarily drawn toward the left, so that the letter becomes formed like a hook. The whole hand also has a tendency to rotate toward the radial side. After writing for from half an hour to an hour, the act becomes very difficult, irregular, and cramped, until, finally, the necessary movements become impossible, although the same movements traced in the air offer no difficulty whatever.

Simultaneously with the above, a painful drawing sensation occurs in the forearm, the thumb is pressed spasmodically toward the middle finger, so that in the course of years a callus has been formed on its third phalanx. After the "cramp" has begun, single letters can still be formed without much trouble, but the writing of whole words is impossible without much pain and exertion; the writing, too, is tremulous, cramped, and illegible.

When this condition of things begins—which naturally is very disturbing to the patient's vocation—he seeks to remedy it by steadying the right middle finger with that of the other hand, and in this way prevents the tendency of the former to move toward the left. For two years past this method has been the only one allowing of continued writing, and even with it he gets along but slowly.

The severest pain is located in the wrist-joint itself and just above, between the ulna and radius. If writing be continued after the pain has once begun, the latter will extend to the forearm, arm, and even shoulder, though here—especially in the supraspinous fossa—it assumes more the sensation of fatigue. It is rather remarkable, too, that when the barometer is low the pain is more intense. The relation between pain in the wrist and the state of the weather is so intimate, indeed, that the patient is able to tell the approach of bad weather twelve to eighteen hours before, simply from the degree of pain and fatigue which writing causes him.

Every emotion, whether of joy or grief, alike intensifies the condition. The best time for writing he has found to be in the morning after having had a good night's sleep and when in a quiet frame of mind. Aside, too, from these well-recognized conditions, every day has its good and bad periods, which occur without discoverable cause.

The baron's calling obliges him to spend often many days at a time, from morning till evening, at his desk writing, and the different phases which his trouble assumes he has observed to occur as follows:

From 8 to 9 A.M. writing is easiest, then from 9 till 12 M. the difficulty increases. In spite of a two hour's rest he is unable to write any better from 2 to 5 P.M. Then, suddenly, and without apparent cause, writing at once becomes easier, so much so, that he saves all his more important correspondence for this time.

When not at his office the patient amuses himself with painting and piano playing, and these occupations, though engaging his right hand constantly, are indulged in for hours without fatigue. He finds difficulty, however, in painting very small objects.

If, while writing, he thinks about himself or if obliged to write very hurriedly, his condition at once becomes worse, and he begins also to sweat. It should be remarked, too, that on waking there is a peculiar sensation in his right hand, the fingers of which feel swollen, and he experiences a certain clumsiness on trying to pick up small objects. But after washing and going through a little exercise in his room, these feelings leave him.

After physical exertion also—an hour's walk, for instance, sufficing—writing is more difficult.

After trying all sorts of treatment, the patient came under my care, August 27, 1882, having received a three months' furlough to give his hand a complete rest.

I began by massaging, in the manner described above, all the extensor muscles of the hand, and, at the same time, I recommended him to learn the zither, my object being to force abduction through the spreading apart of the fingers which playing on this instrument necessitates. At that time I was

unacquainted with Nussbaum's apparatus, which accomplishes the same end, only more perfectly. The thumb muscles, in playing the zither, are likewise used in a manner directly the reverse to that employed in writing. The thumb, namely, plays upon the bass strings—a special "thimble" being worn for the purpose—and in order to reach them it has to be widely separated from the other fingers.

Daily kneading for a month produced no noticeable difference in the patient's condition. About this time he noticed that writing was rendered far easier by grasping with the left hand the right arm just above the condyles.

Finding that mechano-therapy was without effect, I tried hypodermic injections of strychnia, as has been recommended in this disease. I injected every third day half a syringeful of a solution of 0.1 strychnine to 20 water, the first injection taking place on October 30th. The very same day the patient noticed he could write much easier, and that there was no tremor. To be sure, he had played a good deal that day on purpose to tire the muscles of the arm.

Nov. 3. The second injection was given to-day. In the evening, patient wrote without any fatigue or disturbance, and without support of his left hand for an hour and a half. A very surprising result, but, unfortunately, this seeming success proved deceptive.

15*th.* Careful observation has shown that the trouble is less during the prevalence of high barometer, and dry, calm, and clear weather; the opposite conditions increasing it.

28*th.* Complains as before of a wearing pain in the inside of the wrist-joint, and calls attention to the fact that when the hand is moved he can feel a distinct grating—which was, indeed, quite audible to me. I took this to be the result of former rheumatism, and ordered iodine ointment. In a couple of weeks the grating ceased, the pain disappeared, and, wonderful to relate, from that day he was no longer able to prognosticate the weather by his wrist! The state of the weather no longer influenced his writing capacities either, for now he could sometimes write well when the weather was bad, and again, he would have trouble when it was fine. There remained no

doubt, therefore, that his writer's cramp had been complicated by rheumatism.

Dec. 11. The kneading of the forearm and hand, which have been continued, are evidently useless. To-day I read for the first time an account of Nussbaum's apparatus, which was at once sent for. The patient used it for a few days, but experiencing no relief, gave it up.

Jan. 18, 1883. Condition unchanged. The patient distinguishes three stages in his daily condition, as follows:

First, a certain clumsiness is felt, then the writing becomes more easy, then the third stage comes on, which is one of fatigue and inability to control the muscular actions.

No improvement has resulted from mechanical treatment. He has made the following observations on the execution of certain movements of the hand:

1. All movements from left to right and from below upward, especially when these are curved, as in the letter *u*, are difficult to make.

2. Attempted vertical lines are impossible, since they all become curved to the left.

3. Horizontal lines become wavy.

4. All lines made from right to left and from above downward become longer than intended.

5. At times writing proceeds without any difficulty and without any apparent cause for this improvement.

Feb. 6. Of all the means employed none have effected even an improvement. There seems now to be no doubt that the real cause of his trouble lies in a faulty mode of holding the pen. The following figure (Fig. 116), drawn from life, shows the cramped and strained position in which the fingers grasp the pen. The callus on the middle finger is an evidence of the excessive force with which the finger is pressed against the pen (adducted), a testimony which is confirmed by the patient's statement that he has actually broken pen-holders in two while writing, simply from grasping them too firmly. In spite of the unusual development of the muscles in his case, this constant expenditure of continued muscular action only ends in fatigue. For the sake of comparison, I have added an illustration of the correct way of holding the pen. (Fig. 117.)

Unfortunately, although he has made every exertion, the patient is no longer able to acquire the new method. He has made the interesting observation that the muscles of the right

Fig. 116.

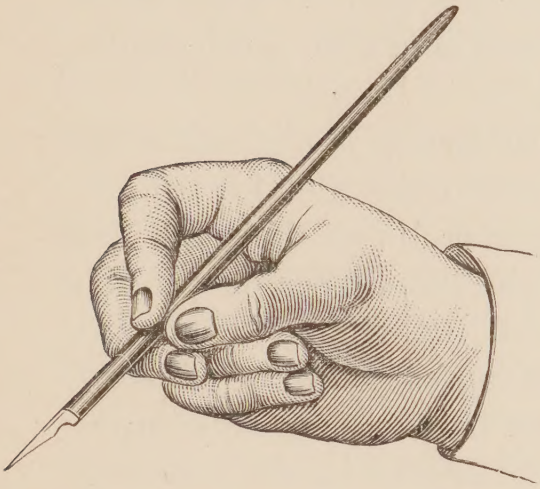
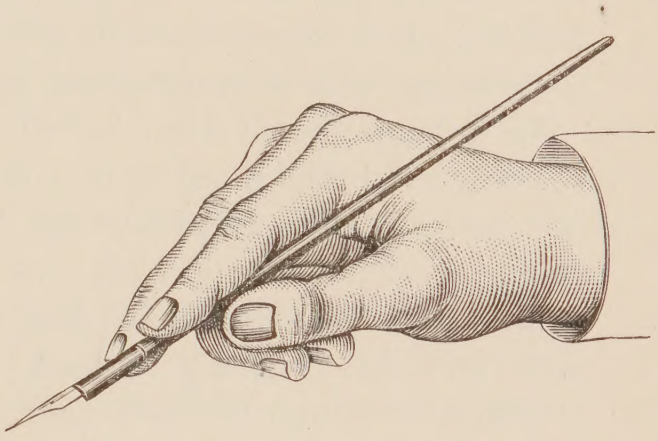


Fig. 117.



forearm, as a result of manipulation, have increased considerably in volume, the increase amounting to one and a half centimetres.

Case XII.—A. V., aged fifty-two, a forestry official from Gmunden; poorly developed and of delicate constitution. In 1877, had gout in left lower and right upper extremities. The subsequent swelling and deformity of the wrist and ankle were cured by a course of sulphur baths in Baden, supplemented by mechanical treatment at the hands of Dr. Kutscher, who applied electricity to the hand and made the patient use rubber balls. Motility was thus entirely restored to the stiffened fingers, so that the patient was not only able to write again, but to engage in elegant penmanship.

In May, 1880, fatigue, finally ending in cramp, was experienced after prolonged writing.

In making the first few letters, the arm would be pronated, but without pain, simply a feeling of complete disability of the flexors occurring. Finally, the right hand becoming entirely useless, he learnt to write with his left, and kept this up for a year, when a weakness, unaccompanied by pain, appeared in the left forearm, soon followed by cramps of the fingers, in which the thumb and forefinger were extended

(Mr. V. says "raised up"), the pen falling from the hand. He then tried to use his right hand again.

Dr. Mayer, of Gmunden, ordered friction of the forearm with chloroform. This caused a feeling of pleasant warmth, and on the day following the patient was able to write more readily. It was consequently continued, and with good results, for writing became much more easy.

In the summer of 1881 he went to Baden again, and while the sulphur baths there caused no amelioration of his trouble, he was so much improved by faradization of the hand and forearm, that writing with the right hand became possible again, although the movements of the fingers were still stiff and the writing lacked all appearance of fluency. Writing continuously for longer than half an hour was impossible without a ten minutes' rest. This was in the morning, but in the afternoon the fatigue would become so marked that after half an hour's writing, half an hour's rest would be needed. He found that he could always write best on a Monday, the Sunday rest having benefited him.

The appearance of the symptoms is as follows: As soon as fatigue begins, tremor sets in, rendering further efforts useless. The muscles of the thumb are the ones most affected. "As soon as I begin to write," says the patient, "the second phalanx of the thumb, which before was firm, grows soft, the skin over it, as well as over the muscles composing the ball, becoming wrinkled. Then pain in the arm gradually develops, and with it, inability to write. Changes in the weather have no effect. Mental emotions, on the other hand, react very markedly, their effects often extending to the following day. Restless or sleepless nights are bad for my condition. After resting for some time an agreeable sensation of warmth spreads through the hitherto cold hand and forearm, after which I can write somewhat better again."

In this case we may safely assume the cause of the trouble to lie in overexertion, especially as the patient's muscles generally were small and poorly developed. Nevertheless, although poorly developed, he had for thirty years been able to write with them from morning till night. It would seem as though the attack of gout in the wrist had produced some degenera-

tion in the muscles and nerves, and that from that time on they had never been able as before to respond to the exertions required of them.

The case would come under the paralytic form of Benedikt's classification.

I recommended daily kneading of the flexors arising in the forearm, and of the thenar and palmar muscles. Also passive motion of the metacarpal bones, in order to affect the interosseous and lumbrical muscles. As the patient lived some distance from Aussee, I taught him the manipulations, and he in turn taught them to his wife.

I further ordered him, the moment he felt fatigue, to stop writing and to allow a stream of cold water to play upon his arm.

This treatment the patient carried out most conscientiously, with the result that at the end of three months he could write for from eight to ten hours without any return of the old symptoms; at the same time, the handwriting itself was much improved. It is interesting to note here that writing with a quill was easier than with a steel pen.

The following reports show the progressive improvements which Mr. V. made.

First Report. September 17, 1882. "The condition of my right hand is so far improved, that fatigue does not occur as soon as formerly, but my grasp of the pen is still very insecure. If I continue to improve as I have done, it will not be long before I am well again."

Second Report. September 22. "Improvement continues. Fatigue after prolonged writing not as great as before; otherwise no change."

Third Report. October 8. "Allow me, my dear doctor, to first answer the questions put to me in your favor of the 29th of last month.

"1. *Are the reports written slowly?* At first the writing is not exactly what would be called slow. It only becomes slow and uncertain after fatigue sets in, which always occurs after I have written for about two hours. There is no pain; only a tiredness which disappears on resting half an hour.

"2. *Is the handwriting normal?* Not yet. Fluency is still greatly lacking, the letters being unequal and angular. I ascribe this condition to the lack of power in the muscles of the

forearm, and I suppose, therefore, that when these muscles have been strengthened by the massage, this disability will vanish. There has been no particular progress since my last report."

Fourth Report. October 20. "As you will see by my writing, considerable improvement has taken place. I can now write at least two hours without experiencing fatigue, but rapid writing is still impossible. I am very well pleased with my progress."

Fifth Report. November 10. "I can now—thanks to the method recommended by you, my dear doctor—write for several hours without any difficulty. I have noticed, however, that a quill suits me best, a steel pen seeming to irritate the muscles of the arm. When fatigue begins there is a slight twitching on the outer side of the forearm only, which disappears after a fifteen minutes rest. My hand looks plumper than it used to, and I notice considerable increase in power."

Sixth Report. December 3. "Since I last wrote you, the twitching, even after prolonged writing, occurs only occasionally. Otherwise nothing new."

Seventh Report. January 14, 1883. "For some time I have been so busy that it has been almost impossible for me to attend to my private correspondence. As I am obliged to write for eight or nine, often ten hours daily, Sundays and holidays not excepted, I am surprised to find the condition of my hand improving nevertheless. Were I only in the position to follow your good advice, I have no doubt my progress would be even more rapid. I still find I can write best with a quill, and shall consequently avoid a steel pen for some time to come. My handwriting may not be so elegant as formerly, but that is of small account.

"Recent trials with Nussbaum's apparatus turned out quite satisfactorily. In my opinion this contrivance might prove very useful to anyone suffering from partial writer's cramp, but if the cramp attacks not only the fingers, but the forearm as well, as was the case with my left forearm, I think it will prove of little or no value.

"It is no aid to my right hand, because the seat of the trouble lies in the forearm."

This criticism of a patient, who has so carefully traced all his symptoms, seems to me well worthy of publication.

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